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and
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The Outlook

On the Other Side

AMID the news of war and destruction with which we are mainly occupied at present it is pleasant to reflect that on the other side of the Atlantic things are going along pretty much as they have done for many months past. One is reminded of this fact by the article by Mr. J. I. Waddington, the first instalment of which appeared in last week's issue of *Flight*.

Mr. Waddington returned recently from a visit to the United States, where he observed with the eyes of an aeronautical engineer "how they do things over there." The result of his observations is given in the article, and several interesting facts emerge.

To us on *Flight* it is particularly instructive to be told by Mr. Waddington that Pan American pilots say, as a result of actual experience and not from theorising, that flying boats could safely alight on and take-off from the Atlantic in a large percentage of cases, and that the moral effect on passengers of being in a flying boat is considerable. That is a view which we have held for a very long time, and have expressed on more than one occasion. Similar sentiments were expressed some years ago by Mr. Hudson Fysh when he flew home to England from Australia. "There is," he said, "an awful lot of water between Darwin and Bandoeng, and a flying boat is a great comfort."

Then Mr. Waddington refers to the use of "giant airliners" such as the D.C.4, and points out that there is a tendency in America, among operators, to doubt the economy of the very large commercial aeroplane. Two D.C.3s cost less to run than one D.C.4 and carry a greater pay load. The main advantage of the larger type seems to be that it can do the coast-to-coast non-stop.

Just now this country is not very interested in commercial aeroplanes, but it *is* interested in bombers, and the essential difference between a commercial aeroplane and a bomber is not so very great after all. Too many eggs in one basket, and all that.

Output

THERE is food for thought in Mr. Waddington's figures relating to the Clark-Fairchild monoplane built of Duramold. The tool cost for the whole machine he puts at 8,000 dollars, or about £1,600. In quantity production that amount would, of course, be split up between the number of machines turned out. The labour cost is a repetitive figure and would have to be borne by every machine, but as it amounts to no more than 35 man-hours for the fuselage, one obtains a very good idea of the speed with which this form of construction could be turned out.

That there would be enormous advantages in building military aircraft by this process is, of course, obvious. But one wonders whether the material has the necessary mechanical properties for use in military aircraft of reasonable size, in which the stresses may be a great deal higher than in the comparatively small and lightly loaded Clark-Fairchild.

Mainly About Engines

IN the second instalment of his article, which appears this week, Mr. Waddington deals at some length with American aero engine development. Apart from the fact that America is hard at work on high-power units, his chief comment, slightly unfavourable to British aero engines, is that the American engines are, on the whole, much cleaner than the British.

Mr. F. R. Banks, in a paper presented to the World Automotive Engineering Congress in San Francisco, has come to much the same conclusion. A summary of the first part of Mr. Banks' paper is published this week, and the full text makes it abundantly clear that this authority favours the American two-valve type of air-cooled cylinder from most points of view. One of the advantages, he states, is that the valve gear can be enclosed and lubricated. Mr. Waddington's comment is that the American claim to better jointing is respon-

"*Flight*" photograph.

RETURNING HOME : Avro Ansons cross the coast line after finishing an anti-submarine patrol.

sible. Actually, both writers are right in that the two-valve head lends itself better to making oil-tight joints, but it is a rather curious coincidence that two authors should, unknown to each other, have commented on this particular feature.

One may take comfort from the view expressed by Mr. Waddington that in liquid-cooled aero engine development Great Britain leads America "by a comfortable margin." And Mr. Banks, in a later part of his paper (not published this week), arrives at the conclusion that for the very large engines of the future the liquid-cooled type will be developed and used more generally than the air-cooled, owing to the necessity for increasing the number of cylinders and the advantage of the liquid-cooled in the closer pitching of the cylinders. So, taking the two statements together, one finds one authority forecasting that the future, for large engines, lies with the type in the development of which the other authority considers we hold a comfortable lead.

N.A.C.

WAR always adds to our mental dictionaries a crop of new initials, with which the man in the street gradually becomes familiar. The degree of familiarity depends rather on which street (Fleet Street, for example) and which war. During the South African war M.I. certainly meant Mounted Infantry. In the last war, and in fact generally, it meant Military Intelligence. Now it undoubtedly means (at any rate in Fleet Street) Ministry of Information Recently readers of *Flight* have grown familiar with C.A.G. and N.A.C.A. has long stood for National Advisory Committee for Aeronautics. Now we must ask them to commit to memory the implications of N.A.C. We will answer the riddle at once. The initials stand for National Air Communications.

N.A.C., in fact, is the metamorphosis of most, but not all, of our civil air transport into a war guise. It has been organised under the Director-General of Civil Aviation, and is used for the transport of key personnel, essential equipment, and stores; and already N.A.C. has flown many thousands of miles on work of this description. It has come to the help of the overworked railways, which covered themselves with glory by the way in which they evacuated the millions of children and others to the reception areas, and are still serving the State well. But the trains are fewer than in peacetime, and sometimes they have to take a long time over journeys. Urgent journeys of people and things need something speedier, and that is where the aeroplane comes in. Of course, the interruption of our normal air transport is deplorable, but it is certainly a good thing for the country that during the war there is a supply of aircraft for National Air Communications.

"STURZBOMBERS"

"DIVE-BOMBING on Warsaw" proclaimed the placards on Monday evening. The specialised German aircraft used for this work are described in detail in an article in this issue of *Flight*.

THE WAR in the AIR

The Royal Air Force Sinks Submarines and Rescues Crew of Torpedoed Grain Ship

Capt. Schofield, of the *Kensington Court*, congratulating and thanking the two R.A.F. pilots who rescued him and his entire crew by flying boats.

FOR the first time in its existence, so far as we remember, the Royal Air Force last week performed lifeboat service at sea. It has, of course, carried out many errands of mercy on land (one need but remember the evacuation of Kabul some years ago), but this time it went to the rescue of the crew of a vessel which had been torpedoed by a U-boat. In America the U.S. Coastguard Service has done splendid work in picking up sick or injured members of ships crews and taken them to hospitals ashore, but this exploit by the R.A.F. is in a category by itself, not only because it occurred in war conditions, but on account of the number of people rescued.

The Court Line grain ship, *Kensington Court*, of 4,863 tons (Capt. J. Schofield, of South Shields, Master), was attacked by a submarine on the Atlantic about dinner-time on Monday, the 18th, and the crew of 34 took to two boats, one of which soon capsized. Its occupants then clung to the sides of the remaining boat. The submarine waited about, evidently hoping to see the ship sink, but a member of the crew said that the grain filled the hole in the hull and kept the vessel afloat for about an hour and a half.

Meantime the ship's SOS had been picked up by two R.A.F. flying boats which were on patrol. They set off at full speed and reached the spot ten minutes before the ship sank. When the U-boat saw them approaching it submerged. The boats made a quick search for it, but did not see any trace, and so did not have a chance of lightening their military load at its expense. Then one boat kept watch overhead, while the other alighted beside the overloaded boat, and took fourteen men on board, some of whom were stated to be in a desperate condition. It then took off—"a difficult feat owing to the heavy load," remarks the Ministry of Information—and the second boat alighted and took the remaining twenty men on board. All were brought safely to shore. It seems that only the speed of the flying boats enabled them to get to the scene in time to prevent loss of life. It is a fortunate thing that the R.A.F. possesses large flying boats which can take off with so many people on board as well as the crew and military load. For this we owe thanks to the civil transport companies which have led the way in developing large types of flying boats, and also to the firms which have been able to meet the demand.

The story of the rescue was told by Capt. Schofield and the two captains of the flying boats after they had reached Great Britain.

Capt. Schofield said he was bringing his ship from Argentina to Birkenhead, carrying a full cargo of wheat. All went well until they were near the British coast, when a submarine was sighted on the starboard quarter. He turned the ship stern on and steamed ahead, and at the same time sent out an SOS. The submarine followed and fired a number of shells, each one dropping a little nearer. He decided it was time to save the crew and gave three blasts on the whistle and stopped the ship. They took to the boats.

"Just then," said Capt. Schofield, "a shell exploded, close to a seaman and caused him to lose his hold on the ropes. The starboard boat capsized. Those in the other boat were able to drag the man on board. As we abandoned ship two shells fell, one on the port side about 100 ft. away and the other on the starboard side at a similar distance. We pulled away from the ship and shortly afterwards we saw an explosion in No. 2 hold on the starboard side.

"A little later we sighted an aeroplane evidently coming in answer to our SOS. We started to cheer, but we did not think it would be possible to rescue us in that way; we thought they had only come to sight us and give some signal to a warship to come and take us off."

Capt. Schofield described the flying-boat alighting on the surface and the arrival of a second flying-boat. The next thing he saw was an officer of the first aircraft coming out on to the wing. The officer signalled, asking how many there were of the crew, and he replied there were 34. The officer then said, 'That is too many. I can take 20 and the rest can go in the other machine." As they were getting on board the flying-boat they sighted a third machine, which circled round while the first and second flying-boats were taking the crew from the boat. "We wondered how they could get us aboard because the sea was choppy, but we saw a door open in the side of the machine and a small collapsible rubber boat was pushed out."

Capt. Schofield said the airmen made them very comfortable, giving them cups of tea, cigarettes, and cheering them up. "One thing more," said Capt. Schofield. "If all the officers and personnel of the R.A.F. are like these young fellows who rescued us, England has nothing to fear."

He added that the submarine gave no warning before opening fire and moved away on the surface when the ship was settling down. There were no other ships in sight.

The pilot of the first aircraft to reach the ship, a Flight-Lieutenant, aged 23, who said he had been in the R.A.F. for two and three-quarter years, said that on Monday afternoon he received a distress message from the ship and proceeded on a course to the place indicated. When they sighted the ship it was sinking by the bows. "After a brief search for the submarine we came down near the boat full of men and stopped the engines. After signalling the men we blew up our rubber dinghy and pushed out with a line to each end, and by this means were able to ferry the men across three at a time. We took 20 men, and then we made a take-off and took them back to 'somewhere in England.'"

The Flight Lieutenant commanding the second flying-

boat, who said he was 25 years old, also described the rescue. He said he could not say more than his fellow-officer except that the other pilot got there first. He received the SOS, and when he arrived saw the other aircraft on the water. He had "a darned good look round" and then alighted and asked how many men he could take. They took 14 in the same manner by dinghy. Among the men he rescued was the third mate, whom he recognised as Maurice Byrne, with whom he had served as an apprentice when he was at sea. The ship they had served in together was the *Vancouver City*, which had been sunk a few days before.

"The vessel sank while the remainder of the crew were getting into position to be taken off by us. It was a shocking sight to see the ship going down. The transfer to the aircraft was not a very difficult matter, although there was a bit of a swell and a slightly choppy surface."

Here Capt. Schofield interposed: "It wasn't difficult for the simple reason that they were so efficient."

R.A.F. Machine Sinks U-Boat

Many German submarines have been attacked by R.A.F. machines, presumably in most cases by those of the Coastal Command, as the Prime Minister indicated in his second review of the progress of the war.

One successful attack was described by the pilot, a South African. He said that he sighted the U-boat two miles away travelling at about twelve knots in an easterly direction. He promptly took cover in a cloud and approached from the stern. He came out of the cloud at about 1,500ft., and as he came closer was able to make sure that the boat was a German. He fired some rounds at a man wearing a white hat standing on the conning tower. As he came down to 500ft., the man disappeared, and the submarine started to dive. She was half under water when the pilot dropped his first salvo of bombs, the nearest of which hit the water 15 or 20 yards directly ahead. The explosion blew the boat back to the surface, which gave the pilot time to turn round, and he then attacked from the port beam. The nearest bomb of his second salvo was a direct hit on the submarine's port side, six feet to the side of the conning tower. There was a terrific explosion, and the whole stern lifted out of the water. She dived into the sea at an angle of 30 degrees. For twenty minutes the pilot flew round over the spot, watching the large whirlpools caused by air escaping from the boat, and the pilot then felt sure that she had been destroyed, so he returned to his base.

When the U.S. steamer *American Farmer* arrived in New York, bringing 29 survivors of the Newcastle steamship *Kafiristan* (5,193 tons) which had been sunk by a U-boat on September 18, one of the passengers, Mr. Armistead Lee, told how they saw a British aircraft attack the submarine. It is not clear if this refers to the same incident as the attack by a South African pilot which is described above. Mr. Lee (as reported by *Reuter*) said that when they sighted the life-boats belonging to the *Kafiristan* they also saw a British bomber that appeared "from nowhere as if by magic."

"The bomber," he declared, "swooped on the submarine and apparently destroyed it with a bomb. There were nine men on the deck of the submarine, but no one appeared to see the bomber coming.

"It sprayed the deck with machine-gun fire and the crews rushed to the conning-tower hatch. The submarine submerged so fast that some of those who were watching aboard the *American Farmer* thought that the hatch was not even fastened down.

"The 'plane circled and dropped a bomb. Then it circled again, dived within 15 feet of the water and dropped another bomb. We saw the submarine's bow lift. Then it slid backwards into the water.

"The bomber flew over us, and one of the fliers waved triumphantly and pointed down as if signalling that the submarine was destroyed."

Capt. John Busby, master of the *Kafiristan*, said the submarine fired a warning shot. Six out of 34 of his crew were drowned in launching the first lifeboat while the *Kafiristan* was still moving.

Recently a reconnaissance R.A.F. machine returning to its base was attacked by three German machines, described

One of the two flying boats circling the *Kensington Court*, looking for the submarine, while the ship's lifeboat is rowed towards the other flying boat.

as fighters, out over the North Sea. They attacked from the rear, and the two outer machines broke away as if to attack from both sides. The leading machine attacked from the rear, and was met with fire. The British machine was able to get into a cloud before the others could attack. Both the gunner and navigator in the R.A.F. machine had to fight under difficulties, as both had had to remove their oxygen lines just before, and the gunner had fainted from shortage of oxygen, while the navigator had also been affected. They recovered just in time to fight the guns.

On another occasion a landplane of the R.A.F. attacked a German flying boat and chased it away. It then proceeded with its reconnaissance. It may be presumed that the flying boat had a good start, for the official statement says that the performance of the British machine was greatly superior.

On the Eastern Front

As was to be expected, the entry of the Soviet Army into Poland brought to an end the organised resistance of the Polish Army, though in a number of places Polish forces continued to make heroic but hopeless resistance. The President of Poland with the members of his Government sought refuge in Rumania, and a great stream of refugees, both military and civil, followed them. Eye-witnesses have stated that over 200 Polish aircraft crossed the frontier and were naturally seized by the Rumanians, while the crews and other fighting men were interned.

Warsaw, however, refused to surrender, and was subjected to intense bombardment by German artillery and aircraft. The heroic Mayor, M. Starzynski, continued to broadcast to the world, describing the horrors inflicted on the city. "I saw," he said, "women and children being killed in the streets while waiting in queues to buy necessities. I saw dead people lying about unattended. I saw with my own eyes to-day the Warsaw cathedral of St. John's badly damaged by enemy bombardment. I visited the famous palace of Belvedere, where Pilsudski lived and died, practically in ruins. I went with the Cardinal of Warsaw to visit the famous churches of the capital, which have suffered from the continual shelling. It was a ghastly sight. I saw the National Art Gallery of Warsaw, treasuring the most famous Polish works of art and of foreign masters, also in ruins. But I have beheld the immeasurable heroism of the citizens and soldiers of this town fighting for the freedom of our country and freedom of our souls." "These Polish men, women and children," the Mayor said, "are not dying in vain, but acclaim they are dying not only for the freedom of their own country but for the freedom of Europe. We know that our friends want to help us and will help us. Our lives may be in danger now but our souls are undisturbed. We shall fight to the last man if we have to go down fighting. We shall stand at our post imbued with holy faith in our ultimate victory even in this dark hour. The day will come . . ."

At this point the Mayor's voice broke and he was unable to proceed.

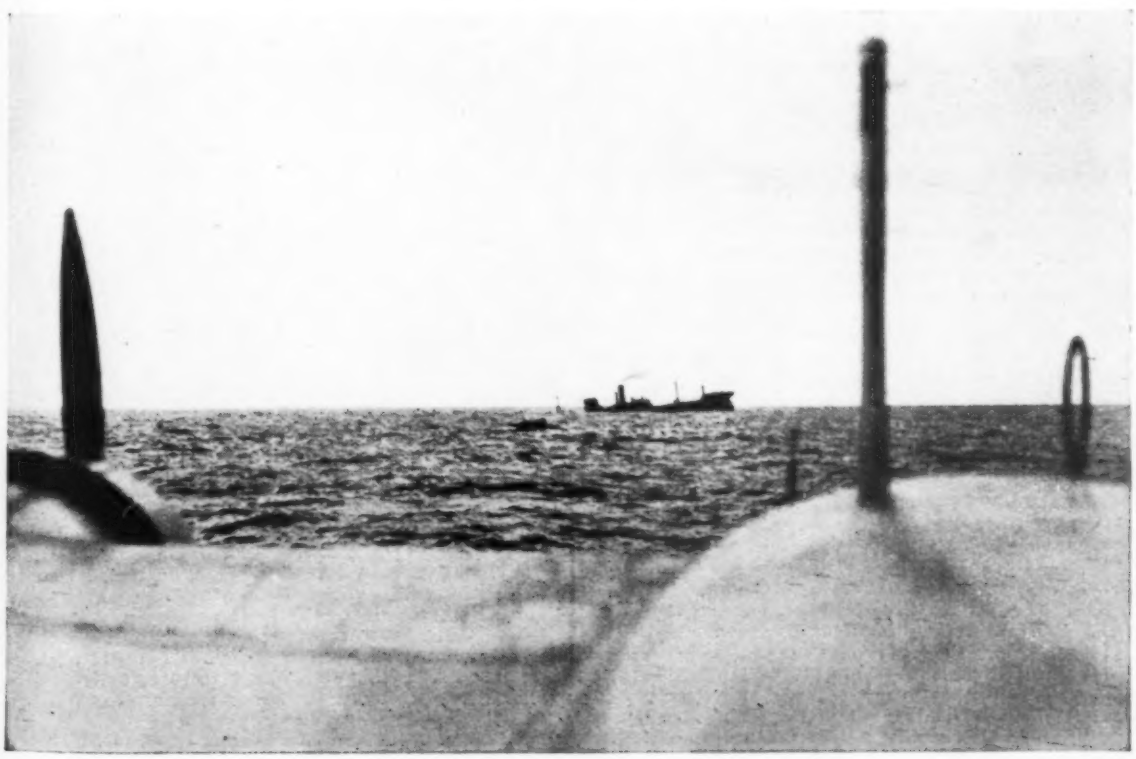
Later accounts say that the Soviet Embassy was destroyed and the Rumanian Embassy damaged in an air raid on Thursday, the 21st, and as the enemy aircraft aimed largely at the shopping centres of the city the dead and wounded numbered 700. A Moscow broadcast added that half of Warsaw was in flames. That same night the Mayor broadcast again, and told one of the most terrible stories of this brutal campaign.

"I want the whole civilised world to know what the Nazi Government means by humanitarian war," he said. "Yesterday in the early hours of the morning seven of our hospitals were bombed, among many other buildings, with terrible results.

"Soldiers wounded on the battlefield were killed in their beds. Many civilians, among them women and children, were killed outright or buried under the ruins.

"But the most barbaric crime was committed on the Red Cross Hospital, which had the Red Cross flags flying from the windows. Several hundred wounded Polish soldiers were there.

"When the Nazi 'planes appeared over the city, raining down death from the blue sky, superhuman heroism was shown by two nurses of this hospital. They climbed up to



The ship's lifeboat approaches one of the flying boats, which has alighted. while the other flying boat keeps watch from the air.

the roof with two more Red Cross flags and spread them prominently.

"The German bombers were flying very low, but the Red Cross flags did not deter them from dropping incendiary bombs on the hospital. The two nurses were killed, and the result was a frightful massacre."

Obviously Warsaw is left with no effective anti-aircraft defence. There can be no balloon barrage to stop the low-flying German bombers, and one notices that no mention is made by the Mayor of A.A. guns or fighter aircraft. In fact, after the mass retreat of the Polish air arm to Rumania there can be very few aeroplanes left which could possibly offer any resistance to the overwhelming onslaught of the German bombers. The defence of Warsaw can only consist of stubborn infantry and artillery entrenched outside the city. These are now under the fire of the German guns, and the strength of the German forces attacking the entrenchments must be continually on the increase. Therefore no possible military object can be served by this horrible carnage in the residential parts of the city. Even without active assault, famine and the exhaustion of ammunition must soon have brought about the surrender of the city. The only conceivable reason for this air slaughter must be the Nazi love of "Frightfulness."

The Germans have not succeeded in getting possession of the Polish oilfield near Lwow (Lemberg) as the Russian forces have occupied that district. A preliminary partition agreement has been concluded by Russia and Germany which cedes that area to the Soviet. The Russian forces likewise separate the German troops from the Rumanian frontier, thus preventing any possible attempts by Germany to secure the Rumanian oilfields.

Mr. Drexel Biddle, the American Ambassador to Poland, who has arrived in Paris, in a statement to the Press, said that in the later stages of the struggle there was no doubt whatever that the whole action of the German aircraft, of which he estimated that 5,000 were employed, was designed to terrorise the civilian population. At first they had concentrated on bombing aerodromes, aircraft factories, training schools and military camps, but afterwards they swept over the whole country, working in shifts.

"It seemed impossible to get away from them," said the Ambassador. "My own car on the way to the Rumanian frontier was bombed 15 times, and machine-gunned four, forcing me to take refuge in a roadside ditch. Finally, I took off the prominent 'U.S.A.' on the roof of the car."

After adding that one train filled with civilians was bombed 72 times between Warsaw and Rumania, Mr. Biddle went on to say that at first Warsaw was bombed only by a few aeroplanes, and from a great height, but the Germans soon discovered that all the available Polish aeroplanes were with the troops, and, emboldened by the knowledge that the capital was undefended from the air, sent more machines working at a lower altitude.

Mr. Biddle estimates that the Germans lost 300 aeroplanes in the campaign.

On the Western Front

On the western front the laconic nature of the French communiqués gives very little information. The French Army has been steadily pushing forward round Saarbrucken. Great artillery duels are reported, in which, as was to be expected, the French artillery are said to have proved themselves superior. The town of Aachen (Aix-la-Chapelle) is said to have been evacuated by the Germans, and there are reports of German forces massing in it and round it. One report has stated that from 1,500 to 1,800 German bombers have been congregated in this region. After the collapse of the organised resistance of Poland a movement of German troops and air squadrons to the West was to be expected. The Governments of Belgium and Holland have been showing signs of nervousness, Belgium having had proof in 1914 of how valueless a declaration of neutrality may be if the German war machine thinks that it may be expedient to march through the territory of a neutral country. The Belgian frontier is, however, formidably fortified in a modern way, which was not the case in 1914.

Naturally, with the Armies engaged in a species of fortress war, the aircraft of both sides have been busy. Rather it should be said that the French and British aircraft, both bombers and reconnaissance machines, have been busy, for the bulk of the German *Luftwaffe* was obviously congregated in Poland, and the German quiescence in the air on the western front was commented upon by French observers. The French advances were, therefore, not much interfered with by the German bombers, while the Allied machines pounded the areas of reinforcement at the rear of the Westwall.

Herr Hitler made a broadcast speech from Danzig on Tuesday, the 19th. In the course of it he said:—

"As you know, I have ordered our air force most strictly to limit themselves only to military objectives. But our opponents in east and west must not take advantage of this. In future we shall take an eye for an eye, and for every bomb we shall answer with five bombs."

If the Führer had wanted to comfort and hearten his subjects, one might have expected that he would have promised them a quick victory over the Allies. Instead of that he said:—

"When England says that the war will last three years, then I can only say that I am sorry for France. If it lasts three years the word capitulation will not arise on our side, nor in the fourth, fifth, sixth and seventh years. About one thing there can be no doubt—we are taking up the challenge."

Perhaps he considers that the spoils of Poland and such supplies as he may get from Russia have enabled Germany to face a long war. One thing is certain; the Russians will want ready money for anything they supply, and the German exchequer is not exactly overflowing with cash or credit.

Finally, Herr Hitler tried to make our flesh creep. He ended with the words:—

"The moment may come when we use a weapon which is not yet known and with which we could not ourselves be attacked. Let us hope that we will not be forced to use this means. It is to be hoped that no one will then complain in the name of humanity."

Mr. Chamberlain made his third interim report on the progress of the war on Wednesday, the 20th, in the House of Commons. In the course of his speech he said: "I can only say that methods are not made humane by calling them so, and that the accounts of German bombing of open towns and machine-gunning of refugees have shocked the whole world." As regards the German submarine campaign, he remarked that he was confident that he was understating the case when he said that already six or seven German submarines had paid the full penalty for their attacks on British shipping.

It may here be remarked that the French Navy also claims to have destroyed four or five U-boats. A very competent authority has estimated that Germany started the war with about 42 U-boats of various sizes. The loss of a round dozen in the first three weeks is a very satisfactory percentage, from the Allies' point of view.

Towards the end of his speech the Prime Minister uttered some very wise words, which apply to the use of our air power as well as of our naval and military forces. He said:—

"There is no sacrifice from which we will shrink, there is no operation we will not undertake provided our responsible advisers, our allies and we ourselves are convinced that it will make an appropriate contribution to victory. But what we will not do is to rush into adventures that offer little prospect of success and are calculated to impair our resources and to postpone ultimate victory. One lesson which military history teaches is that that road leads to disaster. Strategy is the art of concentrating decisive force at the decisive point at the decisive moment."

The Australian Government is offering to despatch six squadrons of the Royal Australian Air Force to reinforce the R.A.F. Four of them will be bomber units and the other two fighters with two-seater aircraft. This will be a very valuable contribution, for the great services of Australian pilots and airmen in the last war are well remembered. Australia was the only Dominion then which raised separate squadrons for the war.

FUELS and ENGINES

Some Observations on Present and Future Development

By F. R. BANKS

Although written primarily for the American audience for which it was specifically intended, the lecture given by Mr. F. R. Banks to the World Automotive Engineering Congress in San Francisco last June is of more than passing interest to British students of fuel and engine problems. Mr. Banks is, as most "Flight" readers will be aware, technical manager of the Associated Ethyl Co., Ltd., and his observations have a very particular significance in view of the fact that this country has gone to war since the paper was written. That some of the views expressed will not be shared by everyone lends added interest to them, and we shall be glad to have the comments of readers.—ED.

The Fuel Position

THE first part of the paper is devoted to explaining the use in British aero engines for the last four or five years of 87-octane fuels to Air Ministry specification D.T.D.230, the knock-rating being obtained by the C.F.R. Modified Motor Method Test, and the author compares the difference in rating between this and the Motor Method used in the United States. The fuels used in British engines are mostly straight-run petrol to which has been added 4 c.c. of lead per Imperial gallon.

Mr. Banks then points out that the British Air Ministry has encouraged the development of engines using 100-octane fuel, and gives results of tests on a Napier experimental unit. He also calls attention to the fact that one British liquid-cooled engine, the Rolls-Royce Merlin, has been rated on 100-octane fuel. He comes to the conclusion that British engines are, on the whole, less sensitive to fairly wide ranges of fuel types than are American engines.

Referring to the question of swirl, Mr. Banks draws attention to pistons from American engines having two-valve hemispherical cylinder heads. Swirl marks are etched clearly on the pistons, and the author expresses the view that where the fuel-air charge is given a rotational swirl as it enters the cylinder, the engine is generally more critical to sparking-plug position, more sensitive to ignition setting, and possibly to the fuel used than is the engine in which this swirl is not present.

He recalled some tests on a liquid-cooled two-valve single-cylinder unit. Two heads were made, one with tangential inlet port to produce swirl and the other with ordinary straight porting. In making the fuel consumption loop, viz., specific fuel consumption against b.m.e.p., the swirl-type head was more sensitive than the normal, and unsteady running occurred when an endeavour was made to extend the loop much beyond the bend in the "weak-mixture" range.

On the other hand, the author expressed the opinion that the typical American two-valve air-cooled cylinder had many advantages as a type. It was easy to manufacture, and the valve gear could be enclosed and lubricated. He had seen, personally, many valves taken from American engines on European airline service which had run for a total of 4,500-5,000 hours, and which had been reconditioned and made fit for further service. In fact, he regarded the American sodium-cooled hollow-head valve as the high-water mark of poppet-valve development. For radial air-cooled engines the two-valve hemispherical head was, he thought, to be preferred to all others, with the possible exception of the sleeve valve. He did not think "fancy" cylinder head shapes were necessary or desirable for aero engines.

Plain and Fancy Fuels

Mr. Banks expressed his agreement with the concluding part of the article by Heron and Beatty in the *Journal of the Aeronautical Sciences* for October, 1938, in which it was stated that "by and large, in the light of present knowledge, straight-run gasolines (or synthetic gasolines of similar properties) and branched-chain paraffins are the outstandingly useful aviation fuels. They are stable in storage, have very low water solubility, give the highest heating values, and their octane numbers are subject to only a slight variation with engine type or operating conditions."

He pointed out, however, that outside America the type of fuel to be used depended somewhat upon the political aspect. "In some of the highly nationalised countries," he said, "home-produced fuels have to be considered and, in Poland, for instance, because of the relatively large quantities of alcohol available, it is probable that di-isopropyl ether will be produced there. In Italy, gasoline/alcohol blends plus lead are encouraged, but some of the air-cooled radial engine types have difficulty in using such fuels for the reasons previously stated, and normal leaded fuels are, therefore, also available.

"Germany makes use mainly of imported straight-run gasolines and, also, synthetically produced gasolines plus lead. So far as I am aware, she does not depend upon the alcohols or benzol to any extent for her aviation fuel requirements.

"Although, in my opinion, British engines operate very well on the so-called temperature and pressure-sensitive fuels, such as the benzol and alcohol blends, the conclusions expressed by Heron and Beatty should apply equally well to Great Britain. In so far as synthetic fuel production in my country is concerned, it is possible that various high-octane blending agents, which vary widely in their characteristics, may be produced; in which case the best use would have to be made of them in time of national emergency, such as war. And, I think, our engines will not suffer too badly in having to digest a wide variety of fuels."

Direct Fuel Injection

"The development in Germany of direct fuel injection is, in my opinion, exceedingly interesting. I am naturally aware of the work which already has been done with gasoline injection in America, but the German aero-engine manufacturers are now in quantity production on injection engines and, apparently, the carburettor is being eliminated steadily, except for the smaller engine types. Personally, I think that it is a step in the right direction, particularly when one considers the distribution problem in regard to the very large engines of the future, having 24, or even more cylinders.

"Timed or direct injection of fuel into the individual cylinders surely will help toward low cruising fuel consumption. But, since this section of my paper is more particularly concerned with correlation problems, I would suggest that direct injection will permit the use of single cylinders (of full-scale engines) for the purpose of fuel correlation, with less chance of the results being affected when the fuel, or fuels, are used eventually in the full-scale motors. Because of the relatively wide mixture-strength range at which the modern engine must operate to give high take-off power and also low cruising fuel consumption, accurate estimation of the fuel/air ratio is necessary during the fuel correlation tests and in my opinion, exhaust-gas analysis should be taken when the tests are being conducted.

"So far as I am aware, all the German injection types spray the fuel directly into the cylinders. In these days when high specific power outputs are required with low fuel consumption for cruising purposes, the importance of obtaining good distribution of the fuel to the engine

cylinders cannot be over-stressed. Modern conditions and requirements have emphasised this point, and have shown that it is not an easy matter to hold a large proportion of 'wet fuel' in the air and make sure that each cylinder receives the same charge quality. I say this, even though I am aware of the good results which are being obtained with some of the modern carburation systems.

"The use of the direct-injection fuel system, although not yet general by any means, possibly will become greater in the next few years and will have some influence on the volatility question. It may be that fuels of very much lower volatility can be used where direct injection into the cylinder is employed. Fuel-injection systems are also being tried in European countries other than Germany, and some are already in an advanced state of development.

"There is yet another important point which has some bearing on fuel volatility and correlation and on the performance of different fuels in full-scale engines. This point concerns the distribution of lead throughout the fuel or fuel fractions in the distribution system of the engine. I have noticed, in one or two cases, that certain cylinders of some engines show a greater amount of lead deposit than others when running at the richer mixtures, that is, when the engine is operating at full power or at a high proportion of its full power. The increase in deposit is more noticeable on the spark plugs than anywhere else, that is, so far as visual examination is concerned.

"This question of lead distribution in the fuel fractions already has been noted and investigated by the Ethyl Gasoline Laboratories in so far as automobile engines are concerned. But I did not think that it would be apparent in an aviation engine because of the latter's different operating conditions, meaning that the aviation engine is, essentially, a constant speed and load job, as distinct from the automobile engine in which the speed and load vary practically the whole time. As previously mentioned, this phenomenon generally occurs in the engines concerned at normal or at rich mixtures, but, when running at the weak mixture condition, the distribution is much improved and all cylinders and spark plugs show (roughly) the same type of deposit, but less in total amount. The explanation of this condition is, apparently, that less total fuel is present in the system at weak mixture conditions, thus tending to more equal distribution."

Mr. Banks then gave some interesting particulars of the fuels used in the Rolls-Royce "R" engines in the Schneider seaplanes. As, however, they were "stunt" fuels they are of relatively small interest at the present time.

Valve Development

On the subject of valve technique Mr. Banks stated that the hollow-head sodium-cooled valve was not employed in British aero engines, mainly because of the use of four-valve cylinder heads, which only permitted the use of small valves. Valves in British engines had sodium-filled stems only, and ran somewhat hotter than the hollow-head type.

The stem-cooled valve suffered from greater liability to scaling and hot corrosion of the head surface. This might lead to detonation and, eventually, to pre-ignition. In order to overcome this trouble some British engine manufacturers coated the valve head with a material known as "Brightray," which was an alloy of 80 per cent. nickel and 20 per cent. chromium. Brightray was superior to Stellite for this purpose. The firm of Rolls-Royce use Brightray for treating the valve face as well as the valve head surface. The result was a great improvement in valve condition. Brightray was much softer, being only about 220-230 Brinell, or similar to the austenitic steel used for the valve itself. The melting point was higher, being about 1,375 C. (2,507 F.). Complete valves from Brightray forgings were now being tried and were, apparently, a success.

While paying a tribute to the work done by the Bristol company on the development of the single-sleeve valve, Mr. Banks did not think that this type of valve would supplant the poppet valve entirely. The poppet valve was not now, and should not be, regarded as the main factor affecting reliability and limiting the operational time of the engine between servicing periods. The limiting factors now appeared to be: piston-ring gumming, the big-end connecting rod bearing of a radial engine, and the centre main bearing in the case of in-line type engines.

(*Another instalment will be published next week*).

High Altitude Investigation

THE Meteorological Department of India have recently been going ahead very strongly with balloon soundings at high altitudes, and such observations are taken at 34 different stations on and off the air routes. In due course, radio sound balloons, giving automatic transmissions, will be used, but at present normal pilot balloons are used, carrying baragraphs and observed by theodolites in the ordinary way. Various types and sizes of balloons are used, but where no risk of delay in observation can be taken, gutta percha balloons are sent up, as these are less liable to premature bursts than those made of rubber.

Each balloon carries a tail consisting of measured string, to which two paper flags are attached at fixed distances—providing the necessary triangulation for height estimation. In night work the flags are replaced by ordinary torches in paper lanterns. More recently a special binocular type of theodolite has been developed by the Agra Observatory to enable a single observer to follow the balloons.

When recording instruments are sent up, as they are from the major stations, these are carried in bamboo cages so that when the balloon bursts the instruments will not be damaged. Meteographs have reached a height of nearly 20 miles, from time to time, and nearly 50 per cent. of the instruments are retrieved.

Joint Red Cross and St. John Appeal

THE following appeal is made by H.R.H. The Duke of Gloucester, Sir Arthur Stanley and Lord Scarborough on behalf of the British Red Cross Society and the Order of St. John, the two bodies having decided to work together under one Joint Emergency Committee.

12, Grosvenor Crescent
London, S.W.1.

In the grave issues which now confront the British Empire, the British Red Cross Society, of which H.M. The Queen is President, and the Order of St. John, have decided to work together as they did in the last war with results which are still within the memory of the Public.

With this object a Joint Emergency Committee has been set up, comprising an equal number of members of each body. Lord Cromer has consented to be the Chairman of the Committee with Major-General Sir John Kennedy as Vice-Chairman.

In this war which is so entirely different from any that has preceded it, it is impossible to foresee exactly where relief for the sick and wounded will be most needed, or in what form. But it is certain that there will be vast suffering and distress and that the relief of the sick and wounded of His Majesty's forces, and of the civilian population, will call for much voluntary effort and financial support.

Considerable voluntary help has already been secured, but it remains to find the money necessary to pursue the work. In the Great War, and indeed at all times, appeals made by the British Red Cross Society and the Order of St. John, received the most generous response, showing that the heart of the Empire is with those who are risking their lives in support of the rights and liberties, not only of the peoples of the British Commonwealth of Nations, but of the whole civilised world.

We earnestly ask you to help the Joint Committee in the great work that lies before them. A fund is being opened in the name of the Joint Bodies. Donations should be sent to The Hon. Sir William H. Goschen, K.B.E., Hon. Treasurer, Red Cross and St. John Fund, at Messrs. Coutts and Co., 1, Park Lane, London, W.1.

Signed: HENRY,
Grand Prior of the Order of St. John,
Chairman of the Council of The British Red Cross Society

Signed: ARTHUR STANLEY,
Chairman of the Executive Council of The British Red Cross Society.

Signed: SCARBOROUGH.
Sub-Prior of The Order of St. John.

GERMANY'S DIVE-BOMBERS

Specialised Types : Diving Brakes and Bomb Displacement Gear

By H. F. KING

A Junkers Ju 87 after a test flight at the Dessau aerodrome.

EVER since its inception the *Luftwaffe* has displayed particular interest in dive bombing. When modern technique is used this form of attack gives a greater degree of accuracy than high altitude or "precision" bombing and dive-bombers are, in consequence, employed against small or moving targets, e.g., individual buildings, cross-roads and junctions, "pill-boxes," tanks and ships.

In dive-bombing the bomb or bombs are released as the machine is pulled out of a dive and not, as is commonly believed, while it is being aimed directly at the target. This is explained by the fact that the bomb does not travel in a straight line after release. Penetration is the same as for a bomb dropped from a machine flying straight and level at a greater height as the dive gives an additional component to the vertical velocity of the projectile. This, of course, does not hold good for heights above which the terminal velocity of the bomb is attained.

So far as we know German dive-bombing tactics are generally similar to those of the other Powers. When an individual machine is attacking it will, if conditions are suitable, dive out of the sun to handicap the anti-aircraft gunners who are likely to be concentrated round targets of the type favoured for dive-bombing attacks. An element of surprise may be possible in cloudy weather. Specialised dive-bomber squadrons practise converging attacks with a view to confusing ground defences though these are by no means easy in view of the steep diving angle and the speeds attained.

Attacks are usually started from a considerable height (say 10,000 ft.) and the pilot may "corkscrew" his machine on its ailerons on the way down further to baffle gunners on the ground. The final aiming dive is made at an angle of 60 to 90 degrees and the bomb released at a height of 1,000 to 3,000 ft. after which the pilot makes his machine as inconspicuous as possible.

Since the introduction of monoplanes it has become imperative to fit some form of air brake to limit the diving speed (and consequently the pull-out stresses on machine and pilot) and to permit a closer approach to the target. The diving speed may also be limited by the use of a reversible-pitch airscrew of the type which has been developed in Germany by the V.D.M. concern. Before these devices became available it is said that German dive-bombing pilots used to tuck their heads between their knees during a bombing dive to minimise the effect of G during the pull-out. A special window was fitted in the floor of the cockpit for sighting.

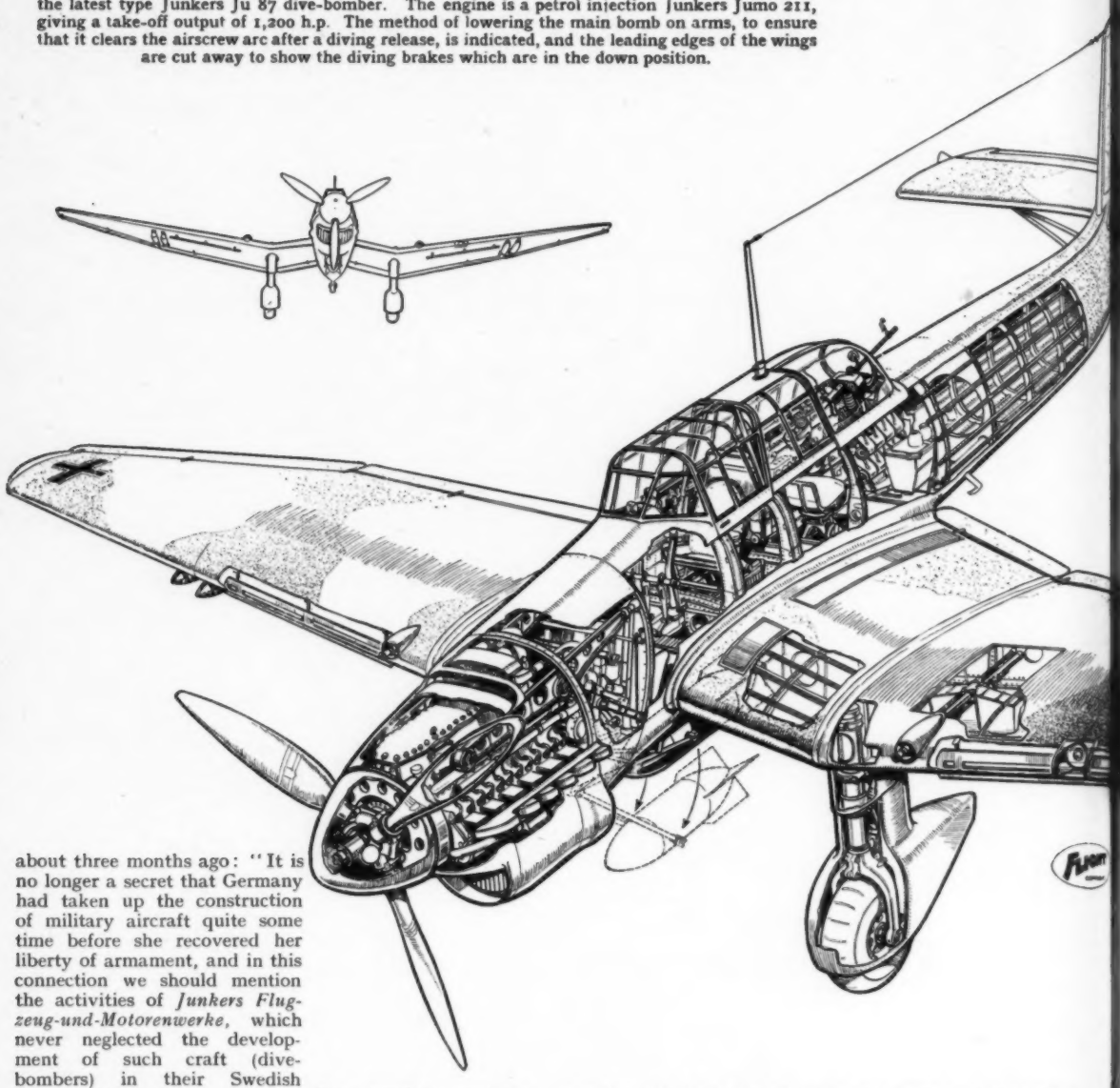
The most widely employed and effective of dive-bombers in service with the *Luftwaffe* is probably the Junkers Ju 87 two-seater which is hereafter described and illustrated in some detail. A standard single-seater is the Henschel Hs 123 biplane which is also dealt with at some length. In addition, the single-seater Blohm and Voss Ha 137 and the two-seater Heinkel machines receive mention. Either, both, or neither of these machines may be in squadron use.

The Junkers Ju 87

To quote a statement issued from the Junkers works

(Top) A unique view from the rear cockpit of a Ju 87 in a vertical dive. The explosion below was caused by a 500 kg. bomb released from one of these aircraft in Spain.

This *Flight* copyright drawing reveals in great detail the equipment, armament and structure of the latest type Junkers Ju 87 dive-bomber. The engine is a petrol injection Junkers Jumo 211, giving a take-off output of 1,200 h.p. The method of lowering the main bomb on arms, to ensure that it clears the airscrew arc after a diving release, is indicated, and the leading edges of the wings are cut away to show the diving brakes which are in the down position.



about three months ago: "It is no longer a secret that Germany had taken up the construction of military aircraft quite some time before she recovered her liberty of armament, and in this connection we should mention the activities of *Junkers Flugzeug-und-Motorenwerke*, which never neglected the development of such craft (dive-bombers) in their Swedish branch works before 1933." The Swedish prototype referred to was the K47, a two-seater with 600 h.p. B.M.W. engine. Bombing trials conducted with the machine by the Swedish Government are said to have given results which have not been surpassed up to the present.

The Ju 87, which is a direct descendant of the K47, is exceptionally easy to recognise because of its sharply cranked wing and fixed undercarriage. It was first seen in public at Nuremburg in September last year and was used effectively during the Spanish War. It is believed to have been active in Poland and, more recently, on the Western Front.

A Spanish writer states that Junkers dive-bombers first appeared in the Spanish conflict at the beginning of 1938 and that they were used on the drive to the Mediterranean coast, during the fighting on the Ebro front and on the Catalonian offensive. The favourite targets in Spain were road crossings and bridges, staff headquarters, harbours and ships. The writer states that a direct hit with 500 kg. (1,100 lb.) of explosive is enough to form a crater which may put even a modern asphalt or concrete road out of condition for days.

The Ju 87s proved particularly successful in the warfare which characterised the final phase of the Spanish conflict, namely, the bombing of ports and ships on the Mediterranean coast. Harbour basins, dock equipment, warehouses and railway sidings were the objects of diving attacks with heavy bombs in consideration of their solid construction. The havoc wrought in Valencia, Tarragona, and Barcelona was due chiefly to the activities of the dive-bombers, which also accounted for a large proportion of the ships damaged or sunk. In particular, one pilot accounted single-handed for three large steamers off Tarragona, each time securing a direct hit.

Structurally, the Ju 87 is not without interest. The fuselage is in two halves, joined approximately along the centre line and giving an oval cross-section. The cantilever wing has the usual Junkers flaps and carries the diving brakes, which take the form of slats mounted just aft of the leading edge on each side. During normal flight these are turned edge-on to the air-stream and when required for use are adjusted through 90 deg. The Junkers concern emphasises that "this means for limitation is not incorporated as a protection against structural failure, as requisite possibly in other designs of dive-bomber, but solely in thorough appreciation of tactical requirements for effective employment of dive-bombers." It is emphasised that the Ju 87 can be pulled out of the fastest dive with

full load and with the diving brakes off in safety.

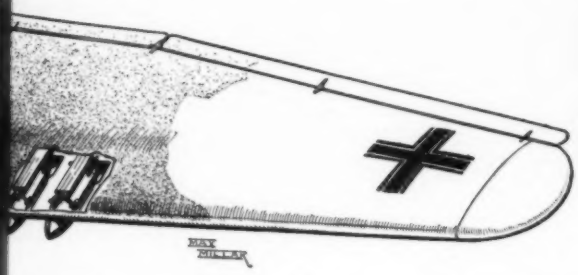
The two-seater arrangement was adopted to give greater defensive fire power on long flights. Armament takes the form of two fixed machine guns (these could probably be replaced by 20 mm. or 23 mm. shell-guns) and a third machine gun on a rotating mounting in the rear cockpit. A single large bomb of 550 or 1,100 lb. is carried behind the radiator housing. In addition, there are racks for four bombs of 110 lb. each under the wings outboard of the diving brakes.

The main bomb is mounted on the deflector fork, which prevents it hitting the airscrew on release in a steep dive.

Complete wireless equipment and night-flying equipment is installed. There is a neat arrangement in the cockpit enclosure permitting the roof to be thrown off in an emergency, and between the two cockpits is a sturdy member to protect the crew in the event of the machine overturning on the ground.

The earlier Ju 87s may be recognised by their large trouser-type undercarriage fairings. In the present model, however, these have been replaced by a spatted design.

The Ju 87 with the trousered undercarriage was fitted with the 650 h.p. Junkers Jumo 210 inverted vee-twelve engine, though the modern type has the Jumo 211 of about 1,000 h.p. This unit is a petrol-injection type and gives a take-off power of 1,200 h.p. Both types of Jumo engines



are very compact and the pilot has a good forward view over the nose in a bombing dive.

Even with the Jumo 211 the performance of the Ju 87 is comparatively low and the top speed at altitude can be little better than 240 m.p.h. Other figures are: T.V. speed without diving brakes, 430 m.p.h.; ceiling, 24,500ft.; all-up weight, 9,350 lb.

The Henschel Hs 123

Of earlier design than the Ju 87, the Henschel Hs 123 single-seater biplane was also used during the Spanish War. This machine is of extremely rugged construction and may be employed alternatively as a single-seater fighter.

The biplane wings are of equal span, the upper having two spars and the lower, one. The structure is of metal, with part metal and part fabric covering. Of monocoque construction, the fuselage is of oval section. No hood is fitted over the cockpit. The undercarriage is somewhat unusual in that it is attached directly to the lower wing; the wheels and legs have streamlined fairings.

In its standard form the Henschel dive-bomber is powered with a B.M.W. 132 nine-cylinder radial of about 660 h.p. Tanks are installed in the fuselage, but when a longer range is required a streamlined container is attached beneath the fuselage between the legs of the undercarriage.

Armament comprises two fixed rifle-calibre machine guns mounted in the top cowling and synchronised to fire through the airscrew arc. Under each wing are racks for two bombs of 110 lb. each; mounted in this position they need no form of deflector. Trailing-edge flaps are fitted on the lower wing, but these are not used as diving brakes.

Data for the Hs 123 are: Span, 34ft. 5in.; length, 28ft.; wing area, 267 sq. ft.; weight empty, 3,085 lb.; weight loaded, 4,651 lb. Performance figures are officially withheld, but the top speed should be 220 m.p.h.

"Bombing up" a squadron of Ju 87s at Kitzingen-on-Main aerodrome. The machines are of the earlier type with trousered undercarriage.

A 500 kg. (1,100 lb.) bomb photographed a moment after release from one of the earlier Ju 87s.

A flight of the original type of Ju 87 dive-bombers. This version has the 650 h.p. Junkers Jumo 210 engine and a comparatively poor performance.

Heinkel He 270

In the last issue of *Flight* reference was made to the Heinkel He 118 single-engined monoplane, which could be used for dive-bombing with a single projectile of 1,100 lb. A development of this aircraft is the He 270, which is generally similar, but has a redesigned cockpit enclosure and a different engine installation. It is not definitely known whether this type is in service with the German Air Force, but the following figures are given as an indication of the potentialities of the modern single-engined dive-bomber.

Fitted with a Daimler Benz Db 600 G inverted vee-twelve engine of 910 normal h.p., the He 270 is claimed to have a top speed of 267 m.p.h. and a range of 1,550 miles with a disposable load of 4,180 lb.

A machine such as this would pick up speed very quickly in a dive, and would demand the fitting of the most advanced form of diving brakes and possibly of a reversible-pitch airscrew.

Blohm and Voss Ha 137

In the same class as the Henschel biplane, in that it is a single-seater dive-bomber, the Ha 137 is structurally of much greater interest. In external appearance it resembles a small single-seater version of the Junkers Ju 87, though, as will be gathered from the illustrations, the design differs considerably in detail.

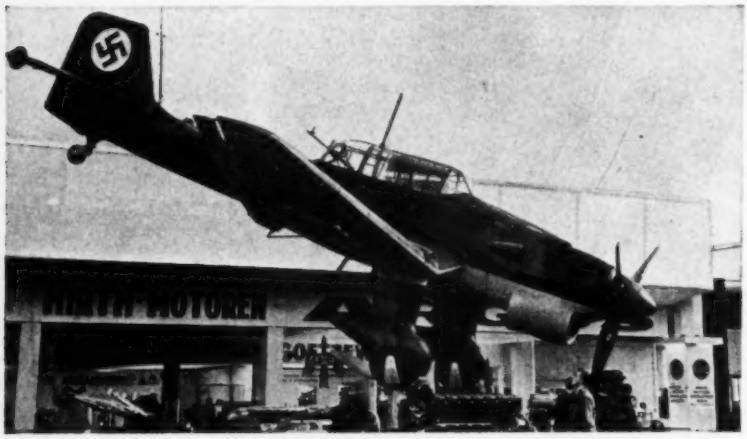
The cranked wing is built round a single tubular spar. In the centre section this is of welded chrome molybdenum steel, though for the outboard panels riveted duralumin is used. The portion which is made of steel is employed as a fuel tank. Hydraulically operated trailing-edge flaps are fitted on the centre section and on the inboard portions of the outer panels. Semi-monocoque construction is used for the slab-sided fuselage, which has two external longitudinal corrugations. The cockpit is open, but there is a streamlined rest to support the pilot's head during violent accelerations.

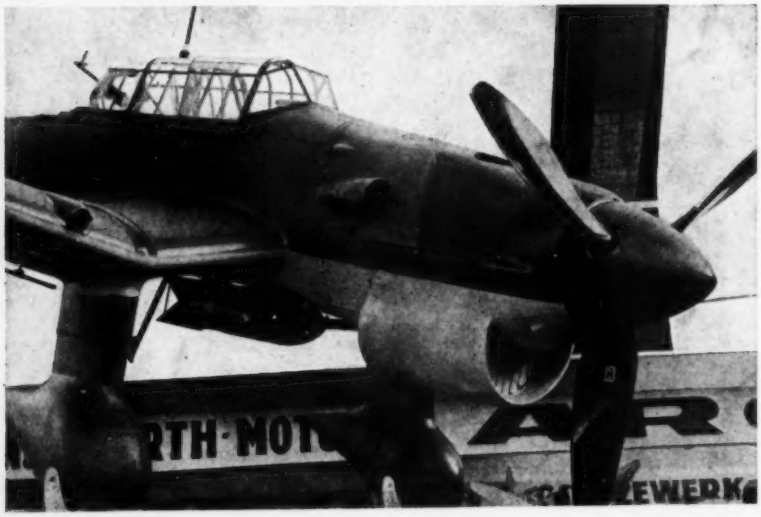
The undercarriage is of the fixed type, and has long fairings which, in association with the cranked wing, recall the first Supermarine fighter (Rolls-Royce Goshawk engine) to be given the name Spitfire. Just above the wheels and within the wing are mountings for two fixed guns. These are normally of rifle calibre, but they may be replaced by heavier weapons such as 20 mm. shell-guns. In addition to this wing-mounted armament there are two fixed synchronised guns in the top cowling. Thus, the machine is potentially a heavily armed, though slow, single-seater fighter. Racks are fitted beneath the outer wing panels for ten bombs of 20 or 22 lb., or four larger projectiles weighing about 100 lb.

The standard power plant is the smaller version of the Junkers Jumo, i.e., the Type 210, of about 650 h.p. This drives a three-bladed Junkers or V.D.M. variable-pitch airscrew.

It would be expected that with this power plant the top speed would be more than the 211 m.p.h. claimed. The cruising speed is given as 185 m.p.h., the ceiling as 23,500ft., and the range as 370 miles.

Incidentally, the Ha 137 ranks as



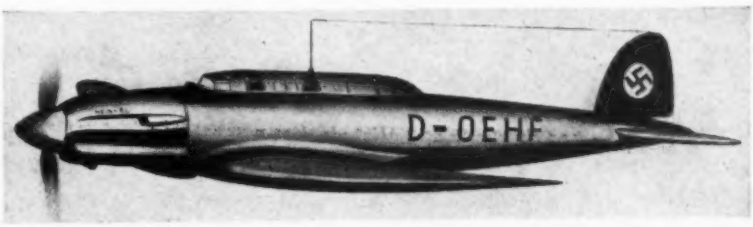


The upper of the two lower views shows a Ju 87 on exhibition at Brussels this year. Below is a close-up showing the installation of the Jumo 211 engine and the method of carrying the single large bomb. The stowage of the smaller bombs is visible in the view of the complete machine.

A study of the Henschel Hs 123 single-seater dive-bomber biplane as used extensively by the *Luftwaffe*. Bombs are carried beneath the wings; the streamlined object beneath the fuselage is a fuel tank.

one of the smallest bombing aircraft in the world.

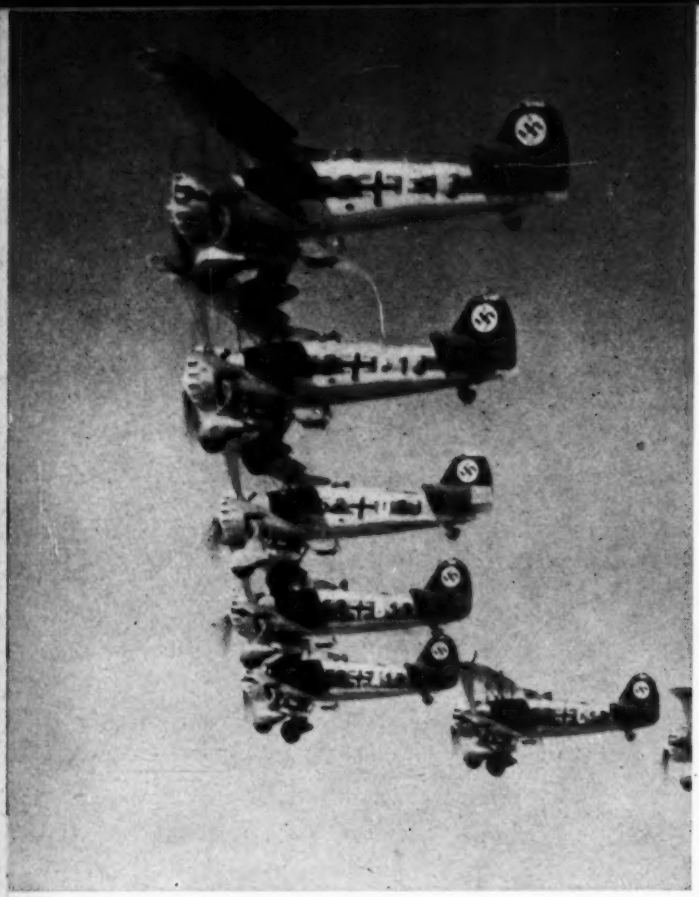
We do not propose to deal here at any great length with the German coastal-defence types, which are virtually general-purpose machines capable of employment as dive-bombers. The best example is the Arado AR 95, a sturdy 2-3-seater biplane with a B.M.W. 132 radial engine. Racks may be fitted to this machine for six bombs of 110 lb. (three beneath each wing) or for a single large bomb of 825 lb. In view of the fact that the machine can handle a torpedo weighing 1,500 lb., it should also be possible to carry a single bomb of 1,100 lb.



The Heinkel He 270, a shapely two-seater, which may or may not have passed into service.

Germany's standard army co-operation type, the Henschel Hs 126 parasol monoplane, can be fitted with racks for a light bomb load which would be used mainly against troops, mechanised columns, etc., though these machines might also be called upon to attack tanks and gun positions.

So far, the machines discussed have been small types



Henschel Hs 123 single-seater dive-bombers of the *Luftwaffe*. It will be seen that these machines are carrying their long-range fuel tanks though no bombs are fitted.

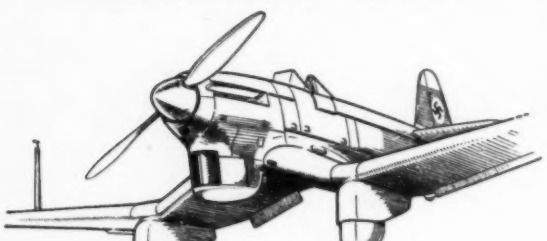
which can be used for bombing from steep dives. The larger twin-engined Dornier Do 17 might also be used for fairly shallow diving attacks with its normal bomb installation, though it is known that external racks may be fitted on the sides of the fuselage, which should permit even steeper approaches.

Indicative of Germany's partiality for dive-bombing were the bomb stowage arrangements on the Henschel Hs 124 twin-engined monoplane. So far as is known, this machine appeared only as a prototype, and was never put into production for the *Luftwaffe*. Weight is lent to this belief by the knowledge that the Henschel concern has for some time been building Dornier Do 17s (in the same category as the Hs 124) under arrangement. The Hs 124 was regarded as a general-purpose machine, and carried twelve bombs, probably weighing about 100 lb. each, externally beneath the fuselage and the centre section of the wing.

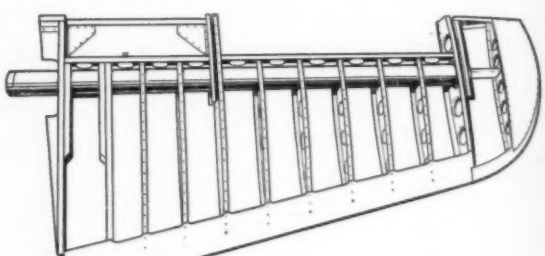
There has lately been a trend in Europe towards the fitting of diving brakes to the smaller types of twin-engined bombers, probably the best-known example being the Fokker G 1. It might be possible to apply similar arrangements to Germany's new Messerschmitt Bf 110 twin-engined fighter-bomber, though the brakes would have to be very powerful in view of the cleanness of this design and the rapidity with which it would gather speed.

During the Spanish War the single-engined Messerschmitt Bf 109, single-seater fighter, was employed for ground attacks, though it is not definitely known that bomb racks were fitted. A drawing depicting a raid on an aerodrome housing a squadron of Russian Rata fighters shows a flight of these Messerschmitts firing with their wing-mounted guns while there are small explosions on the ground. These may be caused by shells from the Messerschmitts' guns or by small fragmentation bombs.

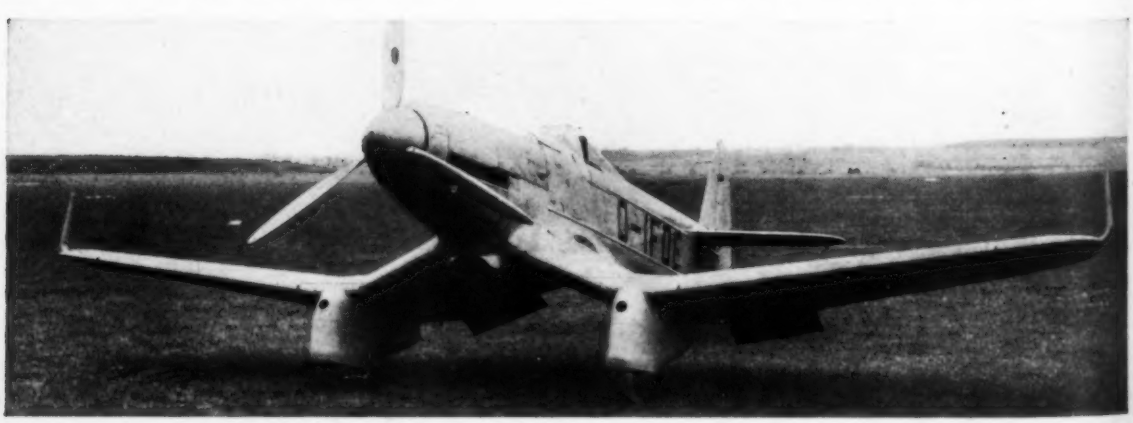
The low-level bombing attack (which must not be confused with the diving variety) is practised by the larger types of German twin-engined bombers, which are unsuitable for steep dives.



The nose of an early type Blohm and Voss Ha 137 single-seater dive-bomber which may be compared with the view of the later type shown below



The wing of the Ha 137 is built round a single tubular spar following standard Blohm and Voss practice. The spar is of chrome molybdenum steel and duralumin.



Like the Junkers Ju 87, the single-seater Ha 137 (type B) has cranked wings which improve the pilot's view. The engine is a 650 h.p. Junkers Jumo 210.

The new 1,600 h.p. Pratt and Whitney Double Wasp installed in a Vultee YA-19 bomber. As this particular engine is without the extension shaft, the spinner shown in the photograph on the next page is not needed.

U.S. Engine Development Compared with British : Controversial Conclusions

AMERICAN METHODS and MODES — II

By J. I. WADDINGTON, M.A., A.F.R.Ae.S.

WHEN I visited the New York World's Fair I expected that the aviation building would be one of the star shows of the whole exhibition. In this I was more than disappointed, for although the officials responsible for this organisation had worked wonders with the materials available, they had been badly starved of both money and representative exhibits. They had been granted only $100,000 with which to run this exhibit for the duration of the Fair, which sum was to include rents and wages, and, in fact, the whole of the expenses of the building. In contrast, the Ford building and contents alone cost $6,000,000.

The actual Aviation Building is inadequate, and its internal arrangements reflect the poverty of its endowments. Amongst the American aircraft firms *not* represented are such important concerns as Douglas, Boeing, Lockheed, Martin and Stinson. The only complete machines shown are Curtiss SBC4 Navy Scout Bomber, Vought SB2U2 Navy Scout Bomber, North American 047 Army Observation, a Vultee Army Attack Bomber, a Curtiss P.36 Army Pursuit with a 1,000 h.p. Pratt and Whitney engine, a Brewster F2A1 Navy Fighter with a Cyclone engine, and a couple of Cubs. There is also quite an impressive full-scale mock-up of the Curtiss Wright twin-motor C.W.20 transport, and it is very effectively displayed.

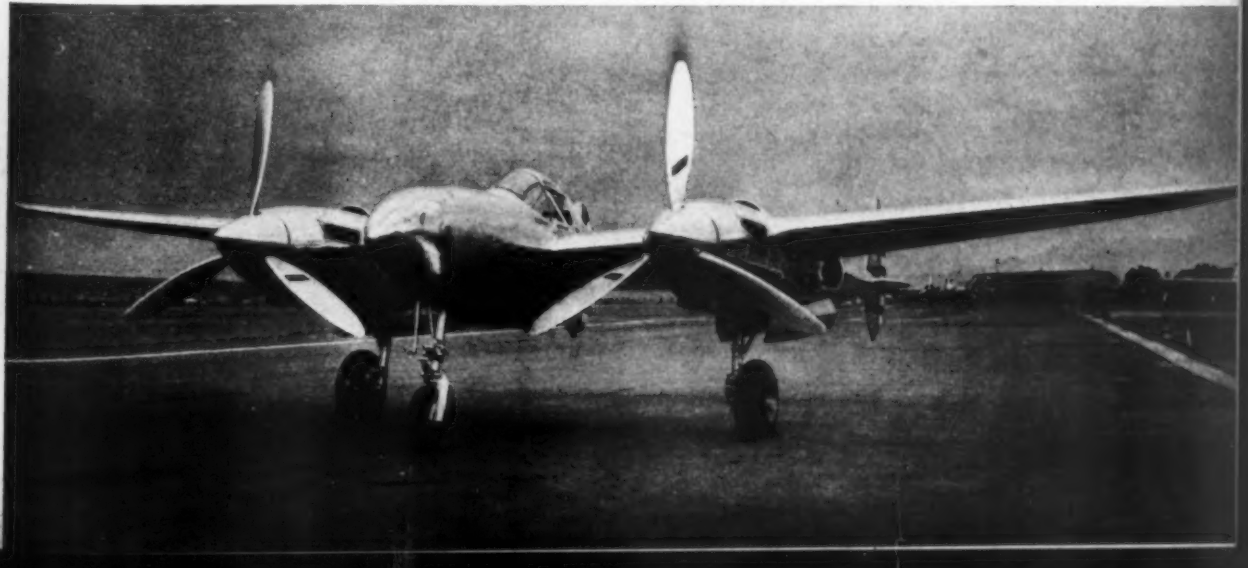
The five major airlines make a fairly good show, but as they are all to a certain extent subsidised, they never dare to spend much money in case the Government thinks that they are making profits and then reduces their subsidies. Their technique in this matter seems to be that of showing practically no trading profit, but the building up of a large reserve in modern equipment. All the aerodrome and accessory people, as well as instrument makers, have good shows, and a Link Trainer is a great attraction for Young America.

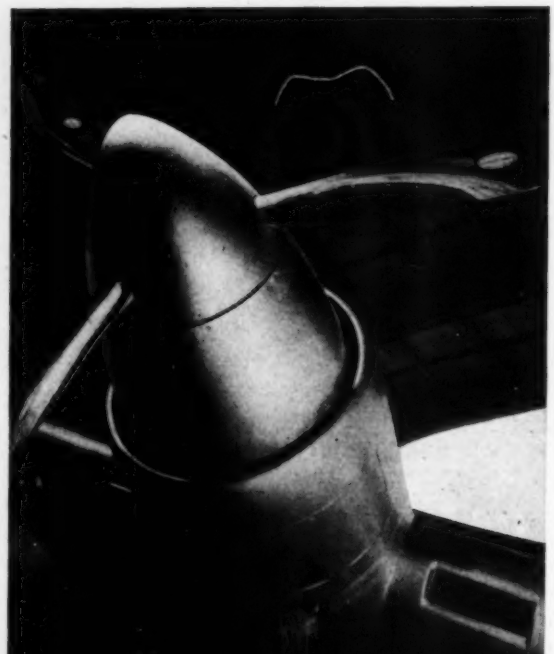
The engine exhibits are a little more representative, and the "secret" Wright 2,000 h.p. Duplex Cyclone is there for all and sundry to see and inspect, in spite of the fact that Wright engineers at Paterson are supposed to maintain semi-secrecy regarding it. As a matter of fact, certain very important accessories on this exhibition model are omitted or replaced by some similar but less secret components. Pratt & Whitney show a 1,400 h.p. double-row Hornet and a cut-away of a double-row fourteen cylinder engine; another cut-away is a Wright G.100 Cyclone.

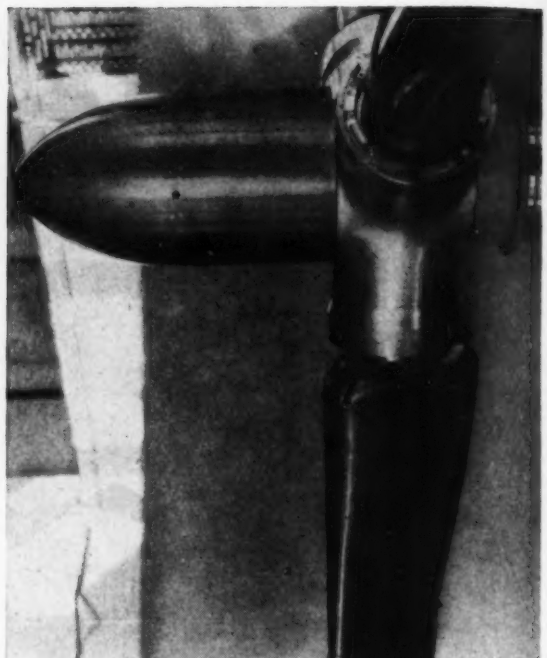
Lycoming shows three engines of the lower h.p. class. Their new 55 Model, installed in a Taylorcraft, produced that remarkable endurance record set up by the Moody Brothers at Springfield, Ill., when they remained in the air for 343 hours and 46 minutes, and even then they would have continued with their flight but for a severe electrical storm. A pretty good performance for a small four-cylinder engine and two men packed into the far from commodious interior of the Taylorcraft for something like a fortnight on end. Throughout this flight refuelling was done by the "catch and carry" method. In other words, the Taylorcraft flew above a moving car and transferred fuel by means of two-gallon tins and a cable from the machine. Too bad that the Short boats cannot do the same.

Interceptor Pursuit is the designation given to the Lockheed XP-38 shown below. Although the prototype was crashed, the U.S. Army Air Corps has placed an order for machines of this type. The engines are Allison vee-twelves with exhaust-driven superchargers.

U.S. Army Air Corps Official Photograph.







This photograph (left) of the wing-installation of the new Pratt and Whitney Double Wasp may be compared with the nose-installation on the previous page. An extension shaft is employed in conjunction with a long spinner to give low drag. Blade root cuffs are being fitted by the Curtiss concern to their electrically controlled, fully feathering airscrew, as shown in the right-hand picture.

Lycoming also produces a bigger brother to this engine, the 65, and also seven and nine cylinder radials varying from 190 to 300 h.p. I also hear that Lycoming have on hand the development of a very large engine, but I was unable to obtain much information on this. Another supposedly hush-hush engine is the 24-cylinder 2,400 h.p. Allison liquid-cooled motor exhibited in the General Motor Building. This engine looks most impressive, but I understand that it cannot yet be considered in any way as a production type. After permitting the horse-power figures for both the Allison and the Wright Duplex to be shown during the first fortnight of the Fair, the authorities decided that a bit of secrecy would be a good ideal and had this information censored.

Britain at the Fair

The foreign pavilions devoted a certain amount of space to aeronautical matters. In our own pavilion we saw a Bristol Perseus XII and a Rolls-Royce Merlin; there were also models of the Mayo Composite, some flying boats, the de Havilland 95 and the new Fairey F.C.1. Italy shows a very interesting tandem 24-cylinder Fiat similar to the air speed record-breaker. It seems remarkable that such a long crankcase can be adequately stiff, as its dimensions overall must be something like 10ft. Other engines on display are a Fiat 1,500 h.p. two-row 18-cylinder, and a 750 h.p. Isotta V-type Delta R.C.35 I. Breda and Alfa Romeo show C.P. airscrews, and there are the usual models of military and commercial aircraft. In the French pavilion there are modern types of aero engines by Hispano Suiza and Gnome-Rhone; there are also C.P. airscrews, instruments and many scale models, including those of transatlantic types.

Turning now to the subject of power-plants and airscrews, I feel that although the American factories still have to travel a long way before they reach our position in liquid-cooled engine design, they have certainly made rapid strides recently in air-cooled radials. Reacting to the stimulus of military requirements it is natural that our liquid-cooled engines should be in advance, and, similarly, commercial operators in America have demanded air-cooled radials, with the consequent rapid development of this type. But if we in England are to expand our air communications it would seem that we could learn considerably from American design in air-cooled engines.

The first engine factory I visited was that of the Ranger Engineering Corporation at Farmingdale, L.I. Although this organisation is comparatively small its members are very much alive, and the quality of their products in workmanship and design is excellent. Without wishing to spend large sums of money on research equipment they have designed and built their own apparatus and have broken new ground in developing the recording instruments they consider necessary for the improvement of their testing technique. They are, however extremely modest about their achievement and certainly seek little publicity for their work. This company was the original holder of cooling patents for in-line air-cooled engines, and they are satisfied that their methods of pressure cooling have overcome all major cooling difficulties for air-cooled in-line engines of any size.

Next I visited the Wright Aeronautical plant at Paterson, N.J., where so many facts were given to me that I came away with a pronounced feeling of mental indigestion and a firm conviction that I had walked at least twenty miles. On this occasion Mr. Mulligan, of the licensing department, was my patient and omniscient guide.

A story is told about a national of an Eastern country which is renowned for its copyist tendencies. It was noticed that this gentleman, who was being conducted round an American factory, insisted on photographing everything he considered interesting. No objection was made to this, but he must have been considerably surprised when his developed films turned out to be blanks. Unknown to himself his camera had been subjected, before he left the works, to the attentions of an X-ray apparatus.

So far as I can gather, the production of the plant at the moment is about 250 engines per month, 85 per cent. of which are Cyclones and Whirlwinds, and over the last three years 50 per cent. of the whole production has been for export. Now, of course, they are developing even larger types, the 2,000 h.p. Duplex already appearing puny by comparison with engines now under test. Incidentally, I heard from other quarters that the Short G. class boats were to be powered with very large Wright engines. The

new 14-cylinder engine of 2,600 h.p. is well on the way to large-scale production, and I was very interested to see under "War Department contracts" in a daily newspaper a modest little item at the bottom of a column—$75,000 to the Wright Aeronautical Corporation for the development of a 42-cylinder aero engine.

Presuming that this engine consists of six banks of the seven-cylinder radial, a modest estimate would be that it would produce about 4,000 h.p.; and from the size of the test houses now being built I gather that Wrights, among others, are envisaging such power units in the very near future. These would, of course, be very suitable for the new big Martin boats.

A characteristic which one noticed immediately when inspecting American engines in service is their cleanliness and freedom from oil leaks, in contrast to the oily deposit left by British engines on the surfaces of wings and cowlings. The Americans' claim to better jointing, which prevents this leakage, is borne out by the low oil consumption figures obtained in service by their engines.

A striking feature of the Wright products is a very close finning on the cylinders, the pitch being not more than 0.2 inches, giving, on the G.100 model, a total cooling area of 2,800 square inches. They suggest that the improved cooling thus obtained is responsible for the low fuel consumption, at cruising revolutions, of .43 lb./B.H.P.-hour. The workmanship on these engines, particularly the machining of these fins, is excellent and the finish, both internal and external, is of the highest order. The layout of the Wright shops ensures a good flow, but the installation of its machine tools struck me as being rather crowded, and there is the added disadvantage of the fact that the building is not very modern. It is laid out on three floors, which entails a certain amount of lost work, and I should imagine that on the upper floors there will be serious vibration problems. From the air the plan view of the building shows the form of a Swastika, which should greatly cheer our mid-European friends. Perhaps, indeed, they will consider it the emblem of another oppressed minority and endeavour to annex the Wright plant from the United States.

A Very Modern Factory

Pratt & Whitney, of Hartford, Connecticut, were the next object of my attentions. There I was received by Mr. Val. Cronstedt, their research engineer. I found a very modern factory which has recently been greatly expanded, and whose production at the moment was estimated at ten engines a day. The plant and equipment were, of course, similar to those of Curtiss-Wright, but had the advantage of being located all on one floor with plenty of working space between the machine tools. This organisation employs 3,600 men and has a large margin for expansion.

Here, again, I found evidences of the development of very large engines, and eight new test houses, four of 24ft. and four of 18ft., were being built. These test houses, in themselves, are big undertakings, built, as they are, away from the main factory and insulated for sound and vibration. I believe they cost about $60,000 each. This factory has recently put into service the most powerful engine ever to pass the 150-hour test of the U.S. Army Air Corps; it is rated at 1,800 h.p. That this power has not been obtained at the expense of increased diameter is shown by the fact that it occupies the same cowling as an earlier 1,200 h.p. engine. Fifteen hundred Twin Wasps and Twin Wasp Juniors are already in commercial and military service.

Ice Prevention

Talking with the Pratt & Whitney engineers the sad subject of the *Cavalier's* crash came up for discussion, and surprise was expressed that more attention is not paid in British engine design to the prevention of icing-up in the carburettor, as tests have shown that under certain conditions of flow in the carburettor intake ice can be formed even at ground level on a normal day. The Pratt & Whitney engines all have intake pre-heating up to 175°F.

I greatly regretted that I was not able to visit the Allison factory. Much interest is being shown in their engines, which have been experimentally installed in Curtiss, Lockheed and Bell aircraft. The 1,200 h.p. model is supposed to be in production, but there seems to be no complete standardisation at the moment, details being different on most of the engines so far delivered. The Allison engineers seem to be meeting with cooling problems, and I was glad to know that Mr. L. T. Delaney, managing director of Gallay, London, who crossed with me in the *Georgic*, was making arrangements in New York to put at the disposal of American engineers the cooling and radiator technique developed so successfully by his company.

As a result of my visits to these various plants throughout the Eastern States, and from what I gathered in conversation of what was going on in the aircraft industry on the West Coast, I formed several conclusions which can be offered for what they are worth. The military needs of the British aircraft industry have caused the development of military aircraft and liquid-cooled engines to a point where they now lead their American contemporaries by a comfortable margin both in design and production, although it is my belief that American production could be stepped up enormously in a very short space of time as they have a plentitude of labour and natural reserves. In military aircraft there is little to choose in workmanship and finish, but if there is any balance at all it is in favour of the American product. On the other side of the picture, we have a long way to go to equal American progress in both air-cooled engines and in commercial and private aircraft, which in my opinion, offer far better value for money than the corresponding British products.

Everywhere, I found a desire for co-operation rather than rivalry, and a generous and broadminded appreciation of the merits of our own aircraft industry.

The New Supply Council

LAST Thursday Mr. Burgin, Minister of Supply, gave the House of Commons an outline of the work done by his Ministry. He also announced that an expansion had taken place, following the lessons of the 1914-18 war, accompanied by the establishment of a Ministry of Munitions Council, with himself as chairman, and the Secretary of the Ministry, Sir Arthur Robinson, as deputy chairman. Admiral Sir Harry Brown continues, as Director-General of Munitions Production, to be responsible for guns, shells, instruments, machine tools and ordnance factories.

Mr. Burgin announced the new appointment of the following Directors-General: Lord Weir of Eastwood (explosives); Mr. Peter Bennett (production of tanks, and mechanical transport); Mr. P. Ashley Cooper (finance); Lord Woolton (equipment and stores). Sir Andrew Duncan becomes chairman of the Committee of Control; Lt.-Gen. Sir Maurice Taylor Senior Military Adviser; Col. J. J. Llewellin Parliamentary Secretary to the Ministry of Supply. Lord Weir, Lord Woolton, Sir Andrew Duncan, Mr. Bennett and Mr. Ashley Cooper had requested permission to serve without remuneration.

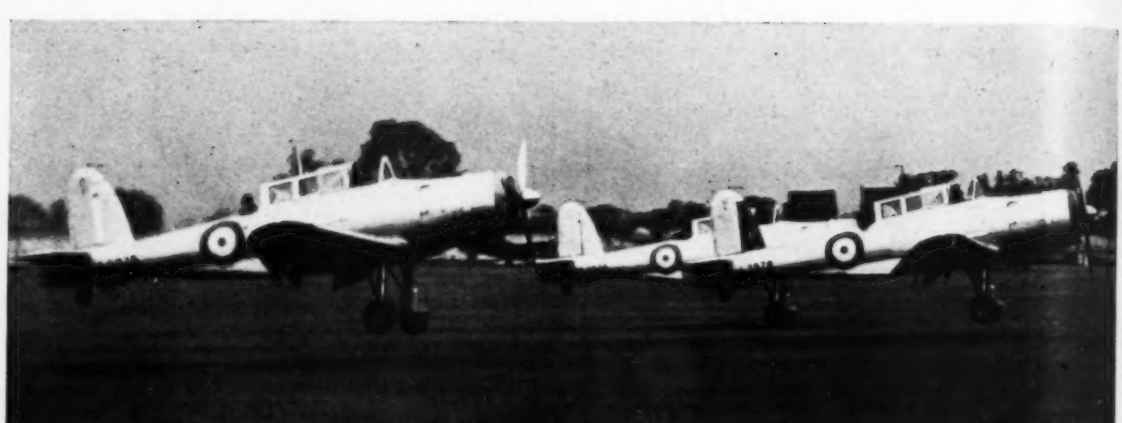
The growth of the air menace, Mr. Burgin said, made the first priority the defence of the country against air attack. The whole of the programme for the air defence of Great Britain had first place.

Expansion of the fighting forces had meant a demand on our machine-tool industry far greater than it could meet on a normal footing, and there must be considerable expansion of output and purchases from overseas. The machine-tool industry was making an immense effort to supply requirements.

The Atlantic Mail Subsidy

THE Civil Aeronautics Authority have now decided on the payments to be made to Pan-American Airways for twice weekly round trips on the Atlantic route. The company originally asked for nearly four million dollars, but the C.A.A. have decided on the somewhat lower figure of $2,454,400, payable for services over either the northern or southern route. Later on, when actual operating data are available, it may be necessary to readjust the rate.

It was estimated by the Post Office department that the return to the Government from the mail service would be well over a million dollars every year. Incidentally, the company's pre-war plans contemplated for the use both of the Boeing 314 and of the Boeing Stratoliner for Atlantic work. Possibly, as the two big airports in Eire are still available, landplanes may yet be used.



"Flight" photograph.

DIVE-BOMBERS: Blackburn Skua I fleet-fighter dive-bombers of the Fleet Air Arm. An article on the dive-bombers of the German Air Force appears in this issue.

SERVICE AVIATION

Royal Air Force and Official Announcement: Fleet Air Arm News

Sir R. Brooke-Popham

H.E. AIR CHIEF MARSHAL SIR ROBERT BROOKE-POPHAM, Governor of Kenya since 1937, is relinquishing that appointment in order to take up work with the R.A.F., from which he retired on his appointment as Governor.

C.A.G.s Warned

THE first batch of Civil Air Guard men, below the age of 28 and holders of A licences, have been warned that they will shortly be called up for interview, and may be required for the R.A.F. Other C.A.G. categories have been warned that they will be called up later. Women members are advised to offer themselves for the Women's Auxiliary Air Force.

First R.A.F. Casualty List

THE first casualty list of the War was issued last Tuesday week, when the Air Ministry announced the following R.A.F. casualties:—

Missing (Believed Killed)

549741 A/C.2 K. G. Day.

Missing (Believed Prisoner of War)

561012 Sgt. G. F. Booth; 36187 P/O. L. H. Edwards; 548555 A/C.2 L. J. Slattery.

Missing

34213 Flt. Lt. W. F. Barton; 546065 A/C.1 G. T. Brocking; 531493 L.A/C. H. Dore; 36138 F/O. H. L. Emden; 537187 A/C.1 R. Evans; 565102 Sgt. D. E. Jarvis; 546679 A/C.1 E. W. Lyon; 580605 Sgt. A. S. Prince; 524808 L.A/C. J. Quilter; 519859 Cpl. J. L. Ricketts; 39340 F/O. J. F. Ross; 552231 A/C.1 G. Sheffield; 550292 Act. Sgt. B. G. Walton.

It is reported from Rotterdam that A/C. Day, who was in a machine which was shot down on September 4, was buried with full military honours at Cuxhaven. The body was picked up by a cargo steamer on September 14 between the Elbe Lightships I and II.

The second casualty list to be issued contains the names of three killed; one reported missing (believed killed); and twenty missing. This list will be published in our next issue.

"Follow Your Trade in the R.A.F."

A FEW days ago an appeal was issued by the Ministry of Information to young craftsmen to volunteer for service in the Navy, Army and Air Force. The appeal is directed to young men in the reserved trades who are not now employed on work of national importance.

For the R.A.F. volunteers are sought in the following trades, and must be below the ages given in parentheses: Electricians (25); fitters (including internal combustion engine fitters but not tool fitters) (23); fitter assemblers (25); instrument makers and repairers (23); motor-drivers (with heavy goods licences) (25); motor-drivers (commercial vehicles, 1½-2½ tons) (30); watch and clock makers and repairers (25); wireless operators (non-seagoing) (30).

Much useful information is given in the booklet "Royal Air Force Trade Groups and Rates of Pay," obtainable from H.M. Stationery Office, and volunteers are advised to apply to the nearest recruiting office for particulars of the experience necessary.

The Penetration of Bombs

THE following figures for the depth of penetration of thin-cased bombs in reinforced concrete are taken from a German source—:

Weight of bomb (kg.)	*Penetration (cm.)*
50	45
100	55
300	80
1,000	125
1,800	150

For soft steel the penetration is one-fifth of the above but for sand it is multiplied by ten.

Royal Air Force Gazette

Air Ministry, Sept. 12

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

T. W. Walker is granted a commission as Flying Officer in Class A with effect from September 1 and with seniority of September 1, 1935; T. B. Byrne is granted a commission as Flying Officer in Class C with effect from August 31 and with seniority of April 14, 1932.

The following are granted commissions in Class CC as Flight Lieutenants on the dates stated:—Flt. Lt. E. E. Ellison (R.A.F.O.) (April 1); F. Marshall, T.D. (April 25); Capt. B. G. St. John-Smith (July 10); Lt.-Cdr. S. R. Sunnucks (R.N., Ret.) (July 24); Capt. C. Baines (August 8).

Lt. F. R. Alford is granted a commission in Class CC as Flying Officer (February 27); F/O. R. A. Ford is granted the acting rank of Squadron Leader in Class CC (August 23, 1938); F/O. (Honorary Flight Lieutenant) A. M. Butt (R.A.F.O.) relinquishes his honorary rank and is granted a commission in Class CC as Flying Officer with the acting rank of Flight Lieutenant with effect from May 7, 1938, and with seniority of August 3, 1937, and is granted the rank of Flight Lieutenant with effect from December 23, 1938; F/O. W. N. L. Cope is transferred from Class A to Class C (August 29); Flt. Lt. W. R. Cox is transferred from Class C to Class A with effect from August 9; P/O. A. F. L. Bowley resigns his commission (June 12); P/O. W. J. W. Kingston relinquishes his commission on appointment to a short-service commission in the Royal Air Force (August 31).

Royal Air Force Volunteer Reserve

General Duties Branch

The following are granted commissions as Group Captains (September 2):—Air Comdre. A. G. Board, D.S.O. (R.A.F., Ret.); Air Comdre. F. K. Haskins, D.S.C. (R.A.F., Ret.); Air Comdre T. C. R. Higgins, C.B., C.M.G. (R.A.F., Ret.); A.V-M. R. P. Mills, C.B., M.C., A.F.C. (R.A.F., Ret.).

T. J. R. Cornewall-Walker is granted a commission as Flying Officer, with effect from September 2 and with seniority March 31, 1934; Capt. K Edwards, D.S.C. (R.N., Ret.), is appointed Hon. Flight Lieutenant (July 10); P/O. A. Obolensky relinquishes his commission on appointment to a commission in the Auxiliary Air Force (August 12).

Administrative and Special Duties Branch

Maj. J. N. Buchanan is granted a commission in the rank of Flying Officer, with the acting rank of Wing Commander (paid) (September 1).

The following are granted commissions in the rank of Flying Officer (September 1):—Lt. Col. A. D. Cameron, J. G. Critchley.

W. R. John is granted a commission in the rank of Flying Officer, with the acting rank of Squadron Leader, for duty as Assistant Provost Marshal (September 1).

The following are granted commissions as Pilot Officers on probation on the dates stated:—G. Frankau (August 26); M. Watney (August 28); H. W. Allen, A. B. Austin, S. Bishop, L. V. Dodds, F. C. Gillman, W. A. J. Lawrence, A. H. Narracott, T. S. Sprigg (September 2); G. B. Ash, E. O. L. Bell, H. C. Bevan, H. V. Campbell, W. Lee, D. H. Lees, W. G. Perkins, H. J. C. Seymour, R. E. Thomas, J. Wilkinson, J. H. Yalden (September 5).

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—C. T. S. Mendl (May 18); D. F. Lapraik, D.F.C., E. L. Moxey (May 21); T. E. Pennington (Acting Squadron Leader) (May 28); T. J. Stannage (June 6); I. C. Tyler (June 11); R. H. Budworth, T. Shortland-Jones (June 25); L. C. W. Trend (July 16); J. H. Baird, F. R. Oddy (July 23); J. V. Wilson (August 23).

F/O. T. E. Pennington relinquishes the acting rank of Squadron Leader (paid) on completion of duty (August 29); Pilot Officer on probation T. Elder-Hearn resigns his commission (May 24).

Accountant Branch

The following are granted commissions as Acting Pilot Officers on probation (September 1):—W. Blair, W. M. Erskine, P. Goldsmith, L. R. Hogg, R. G. Penny, E. F. Summers, K. E. Young, P. Younger.

Meteorological Branch

The following are granted commissions in the ranks stated (September 5):—*Squadron Leader.*—G. J. W. Oddie. *Flight Lieutenants.*—J. Briggs, D. W. Johnston. *Pilot Officer.*—W. R. Hanson, T. Herrod, R. K. Pilsbury.

Auxiliary Air Force

General Duties Branch

The following Flight Lieutenants relinquish their commissions on the dates stated on appointment to commissions in Class CC of the Reserve of Air Force Officers:—R. A. Ford (August 23, 1938); E. E. Ellison (April 1).

No. 501 (COUNTY OF GLOUCESTER) SQUADRON.—The following are granted commissions as Acting Pilot Officers on probation on the dates stated:—H. U. H. Tripp (August 5); P. G. H. Pearson (August 27). No. 602 (CITY OF GLASGOW) SQUADRON.—P/O. P. C. Webb is promoted to the rank of Flying Officer (July 23). No. 608 (NORTH RIDING) SQUADRON.—Acting P/O. R. Burrell is confirmed in his appointment and graded as Pilot Officer (August 4). No. 610 (COUNTY OF CHESTER) SQUADRON.—A. L. Raven is granted a commission as Acting Pilot Officer on probation (August 18). No. 611 (WEST LANCASHIRE) SQUADRON.—Acting P/O. C. H. Macfie is confirmed in his appointment and graded as Pilot Officer (July 27). No. 615 (COUNTY OF SURREY) SQUADRON.—A. Obolensky is granted a commission as Acting Pilot Officer on probation (August 12). P/O. B. N. Murton-Neale is promoted to the rank of Flying Officer (July 4). No. 907 (COUNTY OF MIDDLESEX) SQUADRON.—P/O. E. N. Adlington is promoted to the rank of Flying Officer (August 10). No. 909 (COUNTY OF ESSEX) SQUADRON.—The Hon. J. R. Bethell is granted a commission as Pilot Officer (August 8). No. 912 (COUNTY OF WARWICK) SQUADRON.—The following are granted commissions in the ranks and on the dates stated:—P/O. H. D. Thompson, M.C. (August 2). Acting Pilot Officers on probation.—P. J. Mosedale (July 27); J. Bailey (August 24). No. 913 (COUNTY OF WARWICK) SQUADRON.—Maj. S. T. Hartshorne, M.C., is granted a commission as Squadron Leader and appointed to the command of the Squadron (August 30). No. 914 (COUNTY OF WARWICK) SQUADRON.—The following have been granted commissions in the ranks and on the dates stated:—*Flying Officer.*—F. M. Wright (July 20). *Pilot Officers.*—H. H. Tarrant (July 31); A. F. Goodall (August 2). No. 915 (COUNTY OF WARWICK) SQUADRON.—The following are granted commissions as Flying Officers on the dates stated:—T. R. Poppy (July 13); Capt. D. H. Barnes (July 14). No. 916 (COUNTY OF WARWICK) SQUADRON.—The following are granted commissions in the ranks and on the dates stated:—*Flight Lieutenant.*—Capt. W. B. Bagshaw, M.C. (July 13). *Pilot Officers.*—H. P. Bazeley (July 29); A. H. Wilson (July 31); H. G. Lunt (August 1). No. 917 (COUNTY OF WARWICK) SQUADRON.—A. M. Makepeace is granted a commission as Flying Officer (August 9). No. 918 (COUNTY OF DERBY) SQUADRON.—A. Hollinghurst is granted a commission as Acting Pilot Officer on probation (August 2). No. 919 (WEST LANCASHIRE) SQUADRON.—A. Young is granted a commission as Flight Lieutenant (September 1). No. 920 (WEST LANCASHIRE) SQUADRON.—The following are granted commissions in the ranks and on the dates stated:—*Flying Officer.*—J. W. G. Purser (July 29). *Acting Pilot Officer on probation.*—A. R. Gillespie (July 27). No. 922 (WEST LANCASHIRE) SQUADRON.—J. T. Chorlton, M.C., is granted a commission as Flight Lieutenant (August 24). No. 923 (WEST LANCASHIRE) SQUADRON.—The following are granted commissions as Acting Pilot Officers on probation on the dates stated:—G. Richmond (July 18); T. L. Vickers (July 19). No. 924 (EAST LANCASHIRE) SQUADRON.—The following are granted commissions in the ranks and on the dates stated:—*Pilot Officer.*—R. T. Read (August 30). *Acting Pilot Officers on probation.*—E. W. Collins (August 8); H. Hollins (August 9). No. 926 (EAST LANCASHIRE) SQUADRON.—The following are granted commissions as Acting Pilot Officers on probation on the dates stated:—H. P. Davies (May 19); D. H. Courtenay (August 10). No. 931 (HAMPSHIRE) SQUADRON.—Acting P/O. D. L. Rumble is confirmed in his rank and promoted to the rank of Flying Officer (August 15). No. 934 (COUNTY OF DEVON) SQUADRON.—A. B. Ford is granted a commission as Acting Pilot Officer on probation (August 30). No. 939 (WEST RIDING) SQUADRON.—A. Vernon is granted a commission as Pilot Officer (September 1). No. 940 (WEST RIDING) SQUADRON.—F. J. Kershaw is granted a commission as Pilot Officer (August 31). No. 941 (WEST RIDING) SQUADRON.—Capt. N. Harland is granted a commission as Flight Lieutenant (September 1).

Accountant Branch

No. 911 (COUNTY OF WARWICK) SQUADRON.—F/O. E. A. Titley (A.A.F.R.O.) is granted a commission as Flying Officer (August 14).

Medical Branch

No. 924 (EAST LANCASHIRE) SQUADRON.—C. Roff, M.B., Ch.B., is granted a commission as Flying Officer (August 30).

General List

Sqn. Ldr. (Acting Air Comdre.) H. Peake is promoted to the rank of Wing Commander (Acting Air Commodore) and attached to the Royal Air Force (August 28).

Chaplains Branch

The Rev. L. S. Mann, B.A., is granted a short-service commission with the relative rank of Squadron Leader (September 1); the Rev. O. R. I. Jones relinquishes his short-service commission on completion of service (September 11).

Commissioned Engineer Officers

The following Warrant Officers are granted commissions as Flying Officers on probation with seniority of June 12 and with effect from the dates stated: E. G. Cheesman (August 2); B. Crane, A.F.M. (August 28).

Air Ministry, Sept. 19

Royal Air Force

General Duties Branch

The following Flight Cadets, having successfully passed through the Royal Air Force College, Cranwell, are granted permanent commissions as Pilot Officers (July 29):—H. D. Atkinson, J. S. Barnwell, C. V. Beadon, W. Beringer, J. B Boys-Stones, J. W. Carmichael, P. E. A. Carr, J. Child, P. W. Cook, D. H. T. Dowding, M. H. Franklin, P L. Gordon-Dean, C. I. D. Halliday, G. F. Harding, R. E. Harris, R. V. Herbert, J. B. Holgate, B. Howe, P. A. Hughes, H. S. P. Hulton, P. A. Kimpton, R. B. Knowles, M. D. Lyne, B. G. Mace, R. F. Martin, J. H. K. Parvin, V. J. Pattison, J. E. Preston, H. C. Randall, J. Seeds, T. N. Stack, J. M. Taylor, J. Tillett, J. D. Willis, J. E. R. Wood.

T. C. Parker (from Reserve) is granted a short-service commission as Pilot Officer on probation for six years on the active list (September 1).

The following are granted short-service commissions as Acting Pilot Officers on probation for six years on the active list (September 2):—F. W. Alder, H. R. Allen, C. F. Ambrose, Ll. A. Aviss, R. A. A. Ball, E. B. Bowen, N. E. Canton, A. B. Chalkley, G. G. Cherrington, L. A. Clark, A. R. Covington, P. S. Dally, R. J. Davies, E. G. Dean, F. G. Denman, C. R. Dwight, J. B. Ellis, G. E. Goodman, P. B. Gough, L. A. S. Grumbley, D. J. Hammond, M. H. Hankins, R. H. Hansen, A. T. Harrison, S. J. Herring, W. P. Hopkin, P. A. C. Jackson, F. H. James, P. L. Jarvis, R. J. Jennings, D. S. Kinder, L. F. D. King, R. E. Kirkby, D. F. Lamb, A. E. Le Breuilly, A. G. H. Lindsell, J. A. Littlewood, H. A. Litvin, L. A. Mackay, M. R. MacClancy, C. I. Malcolm, J. E. H. Marshall, S. W. Martin, T. W. Maslin, B. R. Mercer, J. H. D. Mercer, F. G. Millar, D. K. Milne, D. R. Mitchell, C. P. Morse, J. C. M. Mountford, G. H. Muirhead, H F. P. Newhouse, B. T. J. Newland, M. I. Nichols, J. T. Noble, M. Parry, P. N. B. Parsons, L. E. Pearson, R. A. Percy, P. G. Polsue, A. H. Poulsen, T. J. Powell, M. S. Proudlock, A. R. Quemby, J. P. Quirke, J. Rea, R. Reeve, A. E. Rimmer, J. K. Rodger, G. C. Rowe, K. R. W. Shrimpton, V. C. Simmonds, R. A. Sims, D. L. Skinner, A. Smith, A. J. Smith, W. R. C. Sugden, J A. Temperley, F. A. Titcomb, J. E. Turnbull, R. A. Vinson, E. T. Wilkinson, R. G. Winnicott, D. H. Wissier, D. N. Woodger, E. W. Wootten, K. B. Wright, J. V. C. Wyllie, J. H. R. Young.

The following are granted short-service commissions as Acting Pilot Officers on probation for four years on the active list (September 2):—E. W. Allinson, P. W. M. Carlyon, D. P. Clark, B. D. Clarkson, R. H. Dibnah, P. M. Dobree Bell, B. Duncan, G. M.

Goodman, A. B. Jones, J. A. MacGregor, I. S. Simson, N. F. Smith, D. E. Stewart, S. G Tatar, L J. Winbolt.

F/O. R. E. Curry is promoted to Flight Lieutenant (July 26).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—A. W. G. Stuart (June 16); J. R. Guthrie (June 18); B. F. Burbridge, A H. Simmonds (July 14); F. C. Powles (August 4); D. E. Cremin (August 10); D. W. Edmonds (August 16); G. C. Gauthier (August 21); G. H. Wherry, H. R. Jaggard (September 1); F. A. H. Lambart (September 2).

Air Marshal Sir W. G. S. Mitchell, K.C.B., C.B.E., D.S.O., M.C., A.F.C., is granted the acting rank of Air Chief Marshal (unpaid) (September 9).

The following Wing Commanders are granted the acting rank of Group Capt. (paid) on the dates stated:—O. E. Carter, A.F.C. (August 18); A. B. Davidson (September 1).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—J. A. Richards (May 1); R. Bickford (May 6); A. W. Oldroyd (May 11); N. F. Eagleton (June 1); J. E. Baskerville (June 6); B. McCallum, F. Phillips (July 1); C. D. W Price (July 7); M. L. Robinson (July 11); T. H. Clarke (July 23); D. A Robertson (July 24); E. N. Ryder (July 28); J. McC. M. Hughes (August 12); J. A. Richardson (August 16); F. A. Ives (August 27); F. Hume (August 28); D. V. W. Francis (August 29).

The following Pilot Officers are granted the acting rank of Flight Lieutenant on the dates stated:—R. B. Vaux (July 24); G. O. Lister (July 29); C G. Fisher (August 8); T. O. Prickett, A. H. Siminson (August 27).

The following Flying Officers relinquish the acting rank of Flight Lieutenant on the dates stated:—W. P. Cambridge (July 28); P. D. J. Strong (August 12); C. G. Masters (August 18); J. St. J. Thomson (August 25); A. K. Hunter (August 26); T. E. J. Fitton, H. Stringer (August 27); L. F. Gregory, J. L. Waters (August 28).

The following are transferred to the Reserve (Class A (September 16):—Flight Lieutenant.—P. Ruston. Flying Officers.— A. W. Fletcher, D H. C. Hull, A. B. Pringle, H. W. A. Sheahan.

Accountant Branch

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer (June 10):—W. J. Mather, B Crawford.

F/O. P. N. Isaac is granted the acting rank of Flight Lieutenant (August 8)

Chaplains Branch

The following are granted short-service commissions with the relative rank of Squadron Leader on the dates stated:—The Rev. E. Davies, B.A. (September 1); the Rev. E. C. F. Bache (September 4); the Rev. A. R. Bradshaw (September 5).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Air Commodore A. D Cunningham, C.B.E. (R.A.F. Ret.) is granted a commission in Class CC as Group Captain (Honorary Air Commodore) (August 30).

The following are granted commissions in Class CC as Flight Lieutenants (Honorary Squadron Ldr.) on the dates stated:—Sqn. Ldr. C. E. H. C. Macpherson (R.A.F. Ret.) (August 5); Lt. S. L. Matthews, Capt. N. J. A. L. Prinsep, Capt. H. C. Vereker (August 30).

The following are granted commissions in Class CC as Flight Lieutenants on the dates stated:—Capt. G. G. Simpson, D.S.C. (July 10); Capt. W. A. Taylor (R.A.R.O.) (July 21); J. G. Chamberlain (July 25); Flt. Lt. W. Halford, D.F.C. (July 27); Lt. L. G. Graham-Wigan (R.A.R.O.) (July 31); A. A. Radclyffe (August 4); Capt. G. V. Hooton, M.B.E. (R.A.R.O.), Lt. N. B. Morphy, F/O. S. M. Thomas (August 5); Capt. A. Ross-Murray (R.A.R.O.) (August 8); Lt. H. E. Chapman (August 9); Capt. N. Noble, M.C. (R.A.R.O. (August 13); Capt. J. F. H. Hargrave (I.A. Ret.) (August 15); Second Lt. W. A. Downie (August 21).

The following are granted commissions in Class CC as Flying Officers on the dates stated:—Lt. H. S. R. Critchley-Salmonson (July 28); Lt H. E Wood (August 1).

The following Flight Lieutenants are granted the rank of Squadron Leader on the dates stated:—O. C. Cassels, D.F.C. (June 26); F. B. Young (July 24); J. E. M. Atherley (August 19).

The following are granted the rank of Squadron Leader in Class CC on the dates stated:—Flt. Lt. (Honorary Sqn. Ldr.) J. Everidge, M.C. (Sqn. Ldr. R.A.F., Ret.) (June 22); Flt. Lt. F. E. Bishop, M.B.E. (Flt. Lt., R.A.F., Ret.) (July 6).

The following Flying Officers are granted the rank of Flight Lieutenant on the dates stated:—C. N. McLoughlin (June 24); J. C. Walker (July 24).

Flt. Lt. C. E Reynolds is granted the honorary rank of Squadron Leader (June 9).

The following are granted the acting rank of Squadron Leader in Class CC on the dates stated:—F/O. (Acting Flt. Lt.) N. H. F. Unwin (R A.F.O.) (May 1); Flt. Lt. E. A. Sullock, A.F.C. (R.A.F.O.) (July 21).

Pilot Officer T. C Parker relinquishes his commission on appointment to a short-service commission in the Royal Air Force (September 1).

The following Flying Officers relinquish their commissions on cessation of duty on the dates stated:—J. A. Beeney, D.F.C. (July 22); J. H. Leach (September 7).

Equipment Branch

The following are granted commissions in Class CC as Flight Lieutenants on the dates stated:—Flt. Lt. W. B. Frederick (R.A.F., Ret.) (May 8); Maj A. H Graham (May 10).

Royal Air Force Volunteer Reserve

General Duties Branch

Flt. Lt. R. Burges (A.A.F.) is appointed Honorary Wing Commander (September 11).

The following are appointed Honorary Flight Lieutenants on the dates stated:— Maj. C. A. A. Hiatt, M.C. (R.A.R.O) (July 10); Maj. J. B. Browne (R.A.R.O.) (August 14); Capt. C. L. D. Tully, O.B E. (August 21); Lt. Col. H. M. Hankin (I.A. Ret.) (August 25).

Administrative and Special Duties Branch

Brig. Gen. F. L. Festing is granted a commission as Group Captain (September 7); J. S. F. Morrison, D.F.C., is granted a commission as Wing Commander (September 4).

The following are granted commissions as Flight Lieutenants on the dates stated:—J. F. Lewis, H. A. W. Webber, C.B.E. (September 4); D. H. Preist (September 5); A. A. Nathan (September 6); R. C. Hargreaves (September 7).

Lord Ventry is granted a commission as Flying Officer (September 8).

The following are granted commissions as Pilot Officers on probation on the dates stated:—M. P. Gurney (August 28); A. H. Parker (August 31); A. E. G. Forrest (September 5); D. A. Adkins, H. C. G. Allen, F. St. K. Anderson, C. P. Andrews, A. J. Anido, J. Baird, C. P. Beadon, C. R. Beaston, H. B. Bell, P. A. F. Belton, H. L. Benson, M. C. S. Bowley, J. D. Bowman, E. G. Brant, C. Bray, E. Brewer, B F. Briggs, E. J. N. Brown, C. Buckton, J. G. Campbell, G. A. Carr, J. L. Cave, G. H. G. Cawthorne, W. H. Collander-Brown, J. H. Currie, A. E. Cuthbert, C. S. Dawson, G. H. B. Dent, M. Dillon, W. G. Dreschfield, C. M. D. Eales, H. J. English, W. H. Farrow, D.F.C., G. E. Fearon, A. A. Ferguson, P. V. W. Gell, J. L. Girling, D. Goudie, E. A. Grant, T. Harris, E. W. Hindle, B. F. S. Irwin, E. G. Jones, C. D. Kissack, A. J. J. Lamb, R. A. V. Leforgeais, L. H. R. Lewis, E. A. Lloyd, J. McA. MacIntyre, A. Martin, W. D. H. McCullough, J. E. Mulholland, W. Munro, I. W. Parnell, W. Paterson, R. Pierce, E. K. Porte, A. C. Pring, S. Y. Proudfoot, H. V. Rabagliati, V. Ramsden, G. B. M. Reed, V. Rendle, J. Sambridge, H. Sinclair, H. J. C. Smith, M.B.E., H. N. C. Smith, H. P. Smyth-Osbourne, J. Southall, R. C. Taylor, F. H. Thirkell, E. D. Tiddy, P. Toll, S. F. Tolman, J. L. Trollope, C. E. Turner, F. H. Tyas, W. A. Wales, H. C. Walmsley, G. F. Ward, A. B. Wearing, S. C. Weir-Rhodes, J. L. Williams T. H. Wisdom, C. G. Wood, C. F. R. Woolnough, L. M. Wolveridge, C. W. Wrightson, F. Yorke-Smith, A.F.C. (September 9); A F. P. Fane, W. J. Farquharson, R. Steele, N. G. Stewart-Dawson, D.S.O., D.S.C. (September 11).

R. W. Hatcher is granted a commission as Acting Pilot Officer on probation (September 12).

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated:—G. Milner (June 11); B. W. Jeffries (June 18); F. R. Pender (June 19); C. C. Allinson, W. B. Ballinger, D. A. Batwell, S. J. Clinch, D.C.M., D. Jones (June 25); S. Davenport, W. S. Harms, W. Law, G. Stephenson, N. H. Witter (July 2); J. Carroll, M.C., R. A Feggin, R. T. Griffin, S. H. Joelson, M.C., L. J. Swann (July 9); A. E. Davis, A. W. Sawyer, E. A. Simson, A.F.C., N. W. Wickham (July 10); S. F. Lydon (July 16); B. L. Blomley, J. M. Drysdale, D. L. Jacques, A. B. Yuille, A.F.C. (July 23); J. D. Cumming, G. D. Lane (July 30); S. F. B. Lea (July 31); C. M. White (September 2).

Auxiliary Air Force

General Duties Branch

No. 500 (COUNTY OF KENT) SQUADRON.—R. C. Greenlees is granted a commission as Acting Pilot Officer on probation (August 8); P/O. J. Reeves is promoted to the rank of Flying Officer (August 2).

No. 501 (COUNTY OF GLOUCESTER) SQUADRON.—Acting P/O. E. J. H. Sylvester is confirmed in his appointment and graded as Pilot Officer (August 29); P/O. M. F. C. Smith is promoted to the rank of Flying Officer (July 22).

No. 603 (CITY OF EDINBURGH) SQUADRON.—Flt. Lt. J. L. Jack, M.B.E., M.C., is granted the honorary rank of Squadron Leader (August 27).

No. 608 (NORTH RIDING) SQUADRON.—The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—J. W. Woolcock (May 8); J. S. P. Phillips (August 7).

No. 611 (WEST LANCASHIRE) SQUADRON.—O. P. Croom-Johnson is granted a commission as Acting Pilot Officer on probation (August 29).

No. 612 (CITY OF MANCHESTER) SQUADRON.—R. Stone is granted a commission as Acting Pilot Officer on probation (August 21).

No. 614 (COUNTY OF GLAMORGAN) SQUADRON.—H. C. W. Miles is granted a commission as Acting Pilot Officer on probation (July 11).

No. 615 (COUNTY OF SURREY) SQUADRON.—The following Acting Pilot Officers are confirmed in their appointments and graded as Pilot Officers (August 29):—J. C. McK. Hanbury, A. S. C. Rose.

No. 905 (COUNTY OF SURREY) SQUADRON.—F/O. V. A. Cazalet, M.C., M.P., relinquishes his commission on appointment to a commission in the Territorial Army (June 23).

No. 918 (COUNTY OF DERBY) SQUADRON.—The following are promoted to the rank of Flying Officer on the dates stated:—P/O. R. W. Toft (August 15); Acting Pilot Officer on probation E. H. Darwood (August 16).

Medical Branch

No. 923 (WEST LANCASHIRE) SQUADRON.—J. E. La Frenais, L.R.C.P., L.R.C.S., L.R.F.P.S., is granted a commission as Flying Officer (August 11).

Women's Auxiliary Air Force

The following are appointed to the W.A.A.F. in the ranks stated with effect from June 28 and with seniority of the dates shown:—

COMPANY COMMANDERS.—Mrs. F. E. Murray Agnew (October 16, 1938); Miss L. M. Crowther, Mrs. L. M. Hardman (October 18, 1938); Mrs. V. E. Compton (October 25, 1938); Miss P. A. Bayliss (October 28, 1938); Mrs F. M. Hayes, Mrs. K. Ryan (November 2, 1938); Miss A. S. Francklin (November 3, 1938); Mrs. S. Alpine, Mrs. M. W. Pickard (November 7, 1938); Mrs. C. M. Spafford (November 8, 1938); Lady Rachel Stuart (November 10, 1938); Mrs. J. C. Fleming (November 17, 1938); Mrs. E. M. Carby Hall (November 30, 1938); Mrs. D. A. Griffin (December 9, 1938); Miss E. A. M. Llewellyn (January 7); Mrs. C. Woodhead (January 17); Mrs. C. M. McAlery (February 3); Mrs. J. Graham (February 8); Mrs. M. Coltart (February 20); Miss L. M. Turner (February 21); Miss K. J. Trefusis Forbes (February 24); Mrs. K. G. Struan Marshall (March 5); Mrs. J. E. Holcroft (March 9); Lady Catherine Rous (March 10); Mrs. D. M. L. Jones (March 13); Miss L. E. Swatton (March 16); Mrs. M. F. A. Holloway, Mrs. E. M. Macleod (March 29); Mrs. B. W. Ashton (April 13); Miss D. Moon (April 14); Miss W. R. H. Startin (April 17); Miss J. Warren (April 18); Mrs. M. D. Henderson, Miss A. Stephens (April 20); Miss M. Atkinson, the Hon. Margaret Forbes-Sempill (May 4); Miss I. M. Campbell (May 11); Mrs. M. E. Billingham (May 15); Mrs. P. W. Statter (May 16); Mrs. D. M. Midwood (May 25); Miss D. Turner (June 12).

DEPUTY COMPANY COMMANDERS.—Miss B. Graham-Simpson (October 18, 1938); Miss S. S. Dowson, Miss B. M. Wardle, Mrs. M. H. Wardle (November 4, 1938); Mrs. D. I. Smith (November 10, 1938); Miss B. T. Kirby (November 14, 1938); Mrs. E. B. A. Spafford (November 17, 1938); Mrs. M. S. Petrie (November 19, 1938); Miss V. Towler (December 9, 1938); Mrs. A. M. Thompson (December 16, 1938); Lady Doris Shepperson (December 20, 1938); Miss B. J. Y. Yeld-Stephens (December 21, 1938); Miss J. H. Eyre-Matcham (January 11); Mrs. F. M. Greenfield, Mrs. R. Spink (March 28); Miss K. Fell (March 31); Miss E. D. Collins (April 3); Mrs. E. R. McLeod (April 5); Mrs. A. F. Nicholl (April 13); Miss M. M. C. Taylor (April 14); Mrs. M. O. Walker (June 9); Mrs. M. E.-D. Hackforth-Jones, Miss A. McF. Petters (June 17).

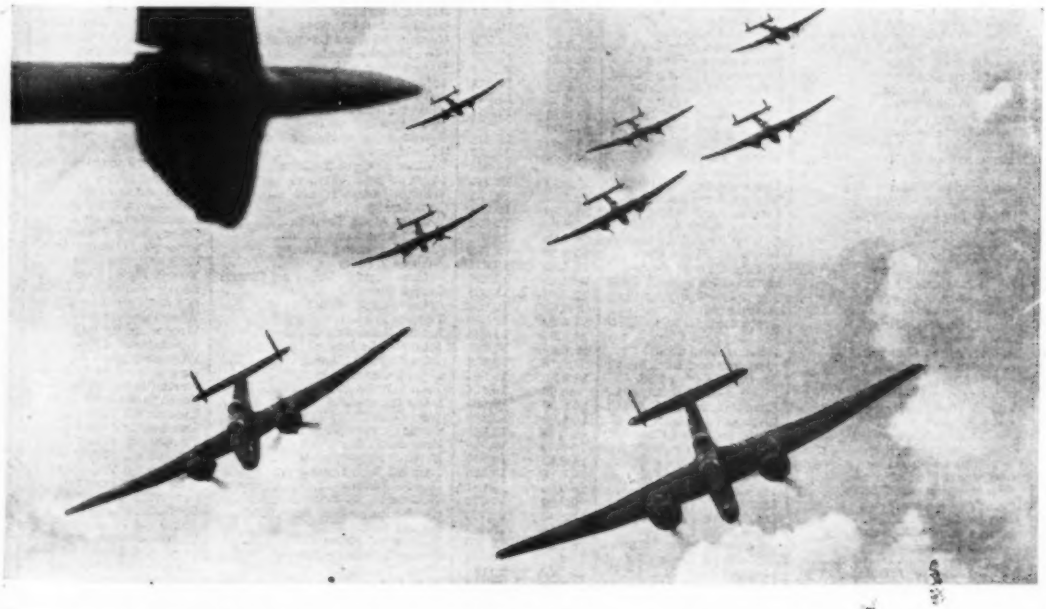
COMPANY ASSISTANTS.—Mrs. P. H. Dunn (October 27, 1938); Miss G. A. Hopkins (November 4, 1938); Miss Z. O. Hill (November 14, 1938); Miss F. M. Pendlebury (November 15, 1938); Mrs. R. M. Kirk, Miss D. J. Leigh-Mallory (November 16, 1938); Miss A. F. Tebbs (November 17, 1938); Miss M. H. Browning, Miss J. V. Price (November 18, 1938); Miss E. N. U. Cottrill (November 21, 1938); Mrs. E. H. Austin, Miss I. C. Mansel (November 23, 1938); Miss G. R. Gibson (November 25, 1938); Mrs. E. M. Gibbons (November 28, 1938); Mrs. D. F. T. Price (November 30, 1938); Miss M. J. Baker (December 3, 1938); Miss M. H. Barnett (December 5, 1938); Mrs. N. V. Cobbold, Miss E. R. Watson (December 14, 1938); Mrs. A. C. Bostock (December 15, 1938); Mrs. K. Amers, Miss M. B. Measures (December 16, 1938); Miss M. B. Ker (December 20, 1938); Viscountess Chetwynd (January 4); Miss J. A. Williams, Miss S. E. Williams (January 7); Miss F. M. Parsons (January 11); Miss N. M. Salmon (January 13); Mrs. E. B. Richdale (January 16); Miss G. M. Bellamy, Miss K. E. Percy Smith (January 19); Miss K. I. Connal (January 21); Mrs. H. Scott, Mrs. K. E. Wright (February 1); Mrs. K. M. Cowan, Miss B. Smedley-Crooke (February 2); Miss A. Graham, Mrs. B. M. McGown (February 14); Mrs. B. Porter (February 16); Miss Y. Barron (February 22); Miss B. P. Derrick, Mrs. E. Frampton, Mrs. D. M. Marris, Miss A. H. Melhuish, Miss M. H. Perkin, Miss C. M. Willis, Miss G. A. D. Wilson (March 3); Mrs. E. B. Appleton (March 7); Miss F. M. C. Duffus, Miss A. M. H. Glossop, Miss R. Y. Smith (March 8); Miss D. M. Lewthwaite (March 9); Miss J. W. Horrocks, Mrs. A. E. Knights, Miss E. F. Lowe, Miss M. H. W. Pumphrey, Mrs. C. V. Wilde (March 10); Miss R. M. Boxles, Miss E. M. Clapham, Miss J. M. Goldsbrough, Miss M. W. Graham (March 11); Miss H. M. Grant, Mrs. K. M. Smardon (March 13); Miss J. B. Orr (March 14); Miss M. McB. Swan (March 15); Mrs. P. M. Moss, Miss M. H. Newton (March 17); Mrs. M. Ballantyne, Mrs. E. H. Sproule (March 20); Mrs. M. T. Bower, Mrs. N. B. M. Pim, Miss A. Thorpe (March 23); Miss H. A. Kennedy, Miss M. E. Miller (March 24); Miss V. L. Scott (March 26); Miss G. H. Caffin (March 27); Mrs. B. C. Beecroft, Miss P. M. de Fraine (March 30); Miss O. A. Davies, Miss M. E. C. Fowler, Miss E. Taylor (March 31); Miss E. C. Bather (April 5); Mrs. E. F. Harker (April 11); Miss B. J. Morris, Miss J. E. Oulton (April 12); Miss K. R. Barnaby, Miss M. M. Bevan (April 14); Miss M. E. B. Whittingham-Jones (April 17); Miss M. M. Collins (April 18); Miss B. B. Hayward (April 19); Miss A. D. Readett-Bayley, Miss D. S. Webber (April 20); Miss G. N. Pamphlett (April 21); Mrs. H. M. D. Duff (April 27); Miss I. N. McDonald (April 28); Miss S. V. Williamson (May 3); Miss A. McH. Aiton, Miss D. E. Carre, Miss M. G. Cope, Miss P. C. Greig (May 4); Miss P. M. Farquharson (May 5); Mrs. C. J. Rowley (May 9); Miss M. H. Lydall, Miss E. M. S. Olsen (May 12); Miss M. Drury (May 16); Miss B. L. Cameron (June 5); Miss M. M. Wade (June 8); Miss J. E. Bailey (June 12); Miss F. Beavan (June 13); Miss J. E. Ainslie, Miss E. Potts, Miss B. W. Smith-Carington (June 19); Miss M. B. Rogerson (June 21); Mrs. M. Z. Pain, Miss J. M. Stirling (June 22); Mrs. A. L. Dennis (June 27).

The following are appointed Deputy Company Commanders on the dates stated: Miss A. K. Arnott (August 25); Miss E. Read (August 28).

The following are appointed Company Assistants on the dates stated: Miss N. M. Lloyd (June 30); Miss M. D. Greenlees, the Hon. Mrs. Olive Murray-Smith (July 1); Miss M. N. Mortimer, Mrs. W. E. Wood (July 4); Mrs. E. Balfour (July 10); Mrs. J. C. Kingsford-Lethbridge (July 12); Mrs. Y. J. Gough (July 13); Mrs. M. I. de C. Taudevin (July 15); Miss B. J. Richardson (July 18); Mrs. J. Huston (July 20); Mrs. P. P. O'N. Maurice (July 23); Mrs. K. M. St. J. Redington (July 25); Miss M. J. Llewellyn, Miss C. M. Nichols (July 27); Miss P. N. Williams (July 31); Miss B. A. Callaghan (August 1); Miss J. E. Neale (August 3); Mrs. M. G. S. Ramsey (August 8); Mrs. D. G. Johnson (August 23); Mrs. R. F. Macklin, Miss M. A. Taylor (August 24); Miss H. K. McN. Kempton, Miss E. N. Simpson, Mrs. K. C. Udal (August 25); Mrs. F. Hanbury (August 26); Miss I. G. E. Greenwood, Mrs. E. M. T. Innes-Crump, Miss A. D. Maurice, Miss F. G. McF. Petters (August 28); Miss M. Hofton (August 30).

Company Commander K. J. Trefusis Forbes is promoted to the rank of Senior Controller (July 1); Company Assistant D. E. Carre is promoted to the rank of Company Commander (August 3).

The following Company Assistants are promoted to the rank of Deputy Company Commander on the dates stated: F. M. Pendlebury (August 29); C. J. Rowley, S. V. Williamson (September 7).



STRIKING POWER. Handley Page Hampden bombers of a type which composes a large portion of our bomber force. Although in service in large numbers the Hampden is still among the most efficient bombers in the world.

THE ROYAL AERO CLUB

Aviators' Certificates

No.	Name	Club or School	Date
19,773	Alan Henry John Sumner ...	Bristol and Wessex Ae. C.	23.8.39
19,774	Peter Mountjoy Arrol Black ...	Bristol and Wessex Ae. C.	23.8.39
19,775	Leslie Charles Iles	Southend Flying Club ...	23.8.39
19,776	Norman Dootson	Northern Aviation Club...	23.8.39
19,777	Hugh Thomas Leoni Smith ...	London Air Park F.C. ...	23.8.39
19,778	Albert Victor Keut	London Air Park F.C. ...	23.8.39
19,779	Gordon Leslie House	Southend Flying Club ...	23.8.39
19,780	Jannette Hollingdale	Brooklands Flying Club...	23.8.39
19,781	Wilhelmina Louise Tucker ...	Brooklands Flying Club...	23.8.39
19,782	Herbert Lea	Brooklands Flying Club...	23.8.39
19,783	Philip McKenzie Veale	Brooklands Flying Club...	23.8.39
19,784	Eric Elrington Addis	Brooklands Flying Club...	23.8.39
19,785	Roderic O'Neill MacAndrew ...	Brooklands Flying Club...	23.8.39
19,786	Robin George Sykes	Brooklands Flying Club...	23.8.39
19,787	Raymond James	Midland Aero Club ...	24.8.39
19,788	Daphne Margaret Isemonger ...	Strathtay Aero Club ...	24.8.39
19,789	John Gilbert Wotherspoon ...	Wiltshire Flying Club ...	24.8.39
19,790	Barbara Mary Nicklin	Oxford Flying Club ...	24.8.39
19,791	Frederick Thomas Stratton ...	Southend Flying Club ...	24.8.39
19,792	Leonard Hull Cox	Southend Flying Club ...	24.8.39
19,793	Harry Ross Hamilton	Romford Flying Club ...	24.8.39
19,794	Robert Warden Harnden... ...	London Air Park F.C. ...	24.8.39
19,795	Ian James Philip	Redhill Flying Club ...	24.8.39
19,796	Neill Wordsworth Marshall ...	Redhill Flying Club ...	24.8.39
19,797	Doreen Christina Wheatley ...	Exeter Aero Club ...	24.8.39
19,798	Douglas Harlow Coleman ...	Thanet Aero Club ...	24.8.39
19,799	Dorothy May Raisbeck	Coventry Aeroplane Club	24.8.39
19,800	Ronald Ross Watt	Thanet Aero Club ...	24.8.39
19,801	Peter George Coleman	West Suffolk Aero Club ...	24.8.39
19,802	Keuneth Emm	Bournemouth Flying Club	24.8.39
19,803	Stephen John Witt	Bournemouth Flying Club	24.8.39
19,804	Ronald John Scott	Bournemouth Flying Club	24.8.39
19,805	Maisie Eveline Montgomery Impey	Bournemouth Flying Club	24.8.39
19,806	Leslie Ernest Danson	County Flying Club ...	24.8.39
19,807	William Masters	County Flying Club ...	24.8.39
19,808	Edward Raymond Pratt	County Flying Club ...	24.8.39
19,809	Donald Ralph Faulkner	County Flying Club ...	24.8.39
19,810	Geoffrey Edward Colley	County Flying Club ...	24.8.39
19,811	Cecil Clayton	County Flying Club ...	24.8.39
19,812	Cecil William Sheppard	Cotswold Aero Club ...	25.8.39
19,813	Cyril Herbert Norman	Plymouth and Dist. Ae. C.	25.8.39
19,814	Albert Leslie Walters	Witney and Oxford Ae. C.	25.8.39
19,815	Alfred Leman Young	Hull Aero Club	25.8.39
19,816	Anthony Alan Frank Mills ...	Hull Aero Club	25.8.39
19,817	Colin Hugh Brodie	Midland Aero Club ...	25.8.39
19,818	Rosemary Joyce Lister Parkes ...	Midland Aero Club ...	25.8.39
19,819	Eric Bernard Paton	Midland Aero Club ...	25.8.39
19,820	John Peck	Doncaster Aero Club ...	25.8.39
19,821	Marguerite Jackson	York and Leeming F.C....	25.8.39
19,822	William Alexander Coulson Browne.	Lincolnshire Aero Club...	25.8.39
19,823	Edward Tomblin	Lincolnshire Aero Club...	25.8.39
19,824	Leonard Charles Storey	Herts and Essex Ae. C....	25.8.39
19,825	Peter Bagnall Coulson	Herts and Essex Ae. C....	25.8.39
19,826	Antonio Louis Favret	Herts and Essex Ae. C....	25.8.39
19,827	Cecil Douglas Russell	Herts and Essex Ae. C....	25.8.39
19,828	Richard Atkinson Clapham ...	Bristol and Wessex Ae. C.	25.8.39
19,829	Mervyn Frank Andrews	Bristol and Wessex Ae. C.	25.8.39
19,830	John Harry Samuel Bebington ...	Southend Flying Club ...	25.8.39
19,831	Richard Henry Smith	Worcestershire F.C. ...	25.8.39
19,832	Cuthbert Roy Farrall	North Staffs Aero Club ...	25.8.39
19,833	Herbert William Henry Perry ...	Doncaster Aero Club ...	25.8.39
19,834	Richard Edgar Jukes	South Staffs Aero Club ...	25.8.39
19,835	Lewis Thomas Oswin	Bournemouth Flying Club	25.8.39
19,836	Alfred Cecil Shilleto	Bournemouth Flying Club	25.8.39
19,837	Charles Edward Prior	Portsmouth Aero Club ...	25.8.39
19,838	John Francis Senter	Cinque Ports Flying Club	25.8.39
19,839	Geoffrey King Croft	Malling Aero Club ...	25.8.39
19,840	Charles Hugh Holden	Isle of Wight Flying Club	25.8.39
19,841	Robert Clifton Battersby... ...	Isle of Wight Flying Club	25.8.39
19,842	Ronald Arthur Wills	No. 34 E. and R.F.T.S., Southend.	25.8.39
19,843	John Charles Wilson	London Aeroplane Club...	25.8.39
19,844	Thomas Starr	London Aeroplane Club...	25.8.39
19,845	William James Sanderson ...	London Aeroplane Club ...	25.8.39
19,846	Philip Wells Jackson	London Aeroplane Club...	25.8.39
19,847	Francis Richard Crossley... ...	London Aeroplane Club...	25.8.39
19,848	Harrington Robley Law	Insurance Flying Club ...	25.8.39
19,849	Arthur Reginald Jayne	Wiltshire Flying Club ...	26.8.39
19,850	Dennis Edward Osland	South Coast Flying Club	26.8.39
19,851	Philip Percy Godfrey	South Coast Flying Club	26.8.39
19,852	Chandos Norman Leigh	South Coast Flying Club	26.8.39
19,853	Alfred Henry Vicars	South Coast Flying Club	26.8.39
19,854	Alan Arthur Ford	Reading Aero Club ...	26.8.39
19,855	Leonard Alfred Shepherd... ...	Reading Aero Club ...	26.8.39
19,856	John Alan Worswick	Liverpool and Dist. Ae. C.	26.8.39
19,857	Cyril Holton	Southend Flying Club ...	26.8.39
19,858	John Bertram Pemberton ...	Liverpool and Dist. Ae. C.	26.8.39
19,859	William Harold Harford-Jones ...	Liverpool and Dist. Ae. C.	26.8.39
19,860	David Jones	Liverpool and Dist. Ae. C.	26.8.39
19,861	John Thomas Taylor	Wiltshire Flying Club ...	26.8.39
19,862	Victor Charles Sherring	Wiltshire Flying Club ...	26.8.39
19,863	Cecil Stuart Roberts	London Air Park F.C. ...	26.8.39
19,864	John Stuart Harris	London Air Park F.C. ...	26.8.39
19,865	William Hammond Clisby ...	London Air Park F.C. ...	26.8.39
19,866	Frederick Charles Brown ...	London Air Park F.C. ...	26.8.39
19,867	John James	London Air Park F.C. ...	26.8.39
19,868	Maurice Stanley Barrett	London Air Park F.C. ...	26.8.39
19,869	Nathaniel Berry	Brooklands Flying Club...	28.8.39
19,870	Oonah Kay...	Brooklands Flying Club...	28.8.39
19,871	Richard Furryan Fisher	Liverpool and Dist. Ae. C.	28.8.39
19,872	Ronald Ivor Nurse	Wiltshire Flying Club ...	28.8.39
19,873	Robert Everson Peters	Wiltshire Flying Club ...	28.8.39
19,874	Eric Walter Vass	Bournemouth Flying Club	28.8.39
19,875	Royton John Mitchell	Bournemouth Flying Club	28.8.39
19,876	John Alexander Graham ...	Strathtay Aero Club ...	28.8.39
19,877	Jack Henry William Wood ...	Bristol and Wessex Ae. C.	28.8.39
19,878	Norman Peter Wiseman	Redhill Flying Club ...	28.8.39
19,879	John Llanwarne Cribb	Redhill Flying Club ...	28.8.39
19,880	Geoffrey Alexander Festing Parry	Norfolk and Norwich Ae.C.	28.8.39
19,881	Arthur Kenneth Smith	Norfolk and Norwich Ae.C.	28.8.39
19,882	John Frederick Gent	Airwork Flying Club ...	28.8.39
19,883	Harold Quittenden	Airwork Flying Club ...	28.8.39
19,884	Dermot Vigors Thesiger	Airwork Flying Club ...	28.8.39
19,885	Whitney Dickinson	Bedford Aero Club ...	28.8.39
19,886	Kenneth Frank Jolly	Bedford Aero Club ...	28.8.39
19,887	Stanley Davis	Bedford Aero Club ...	28.8.39
19,888	Albert Victor Scott	Bournemouth Flying Club	28.8.39
19,889	Ernest Edward Wrixon	Bournemouth Flying Club	28.8.39
19,890	Alexander John Nicholson ...	Cardiff Aeroplane Club ...	28.8.39
19,891	Godfrey John Williams	Cardiff Aeroplane Club ...	28.8.39
19,892	Clifford Dennis Hunt	Cardiff Aeroplane Club ...	28.8.39
19,893	David Hamblin	Cardiff Aeroplane Club ...	28.8.39
19,894	Claude Edwin Hawkins	Bournemouth Flying Club	28.8.39
19,895	Stanley Curry	Bournemouth Flying Club	28.8.39
19,896	Roger Ivan Mutimer	Norfolk and Norwich Ae.C.	28.8.39
19,897	Joseph King	Norfolk and Norwich Ae.C.	28.8.39
19,898	Herbert Arthur Allen	Norfolk and Norwich Ae.C.	28.8.39
19,899	Bernard Leslie Dominic Allen ...	Norfolk and Norwich Ae.C.	28.8.39
19,900	Tom Francis West Gunton ...	Norfolk and Norwich Ae.C.	28.8.39
19,901	William Percy Pratt	Norfolk and Norwich Ae.C.	28.8.39
19,902	Edwin Lionel Radford	Norfolk and Norwich Ae.C.	28.8.39
19,903	Henry James Crooks	Southend Flying Club ...	28.8.39
19,904	John Coventry Phillips	Southend Flying Club ...	28.8.39
19,905	Reginald Philpot	Southend Flying Club ...	28.8.39
19,906	William Donald Tarr	Southend Flying Club ...	28.8.39
19,907	John Wynford Marsh Jones ...	Lincolnshire Aero Club ...	28.8.39
19,908	Charles Henry Cole	Lincolnshire Aero Club ...	28.8.39
19,909	Albert William Dukes	Herts and Essex Ae. C....	28.8.39
19,910	Charles Walter Lawson	Herts and Essex Ae. C....	28.8.39
19,911	Herbert Ivy Valentine Peters ...	Herts and Essex Ae. C....	28.8.39
19,912	Denis Francis Buckle	Herts and Essex Ae. C....	28.8.39
19,913	Victor Wood Lea	Herts and Essex Ae. C....	28.8.39
19,914	Francis Reginald Sorge	Herts and Essex Ae. C....	28.8.39
19,915	Jack Richard Thomas Hazelton...	Horton Kirkby F.C. ...	28.8.39
19,916	Arthur Clayton	Horton Kirby F.C. ...	28.8.39
19,917	Lionel John Alexandroff	Horton Kirby F.C. ...	28.8.39
19,918	Stewart Sidney Savage	Horton Kirby F.C. ...	28.8.39
19,919	Arthur Gilbert Rugg Dimond ...	Horton Kirby F.C. ...	28.8.39
19,920	Dennis Joseph Devlin	Horton Kirby F.C. ...	28.8.39
19,921	Ian Campbell Burke	Horton Kirby F.C. ...	28.8.39
19,922	Ronald Malcolm Sanders ...	Horton Kirby F.C. ...	28.8.39
19,923	Roy Edward Coleman	Horton Kirby F.C. ...	28.8.39
19,924	Robert John Neville	Horton Kirby F.C. ...	28.8.39
19,925	Sydney Walter Slaughter ...	Horton Kirby F.C. ...	28.8.39
19,926	William Reginald Turner... ...	Yorkshire Aeroplane Club	29.8.39
19,927	Rosemary Lilian Fuller-Hall ...	Romford Flying Club ...	29.8.39
19,928	Bernard William Channing ...	Isle of Wight Flying Club	29.8.39
19,929	Arthur Henry George Portch ...	Exeter Aero Club... ...	29.8.39
19,930	Irene Joy Ferguson	Ipswich Aero Club ...	29.8.39
19,931	Kemble Charles Upson Parker ...	Ipswich Aero Club ...	29.8.39
19,932	Alastair Gordon Gillies McBain ...	Scottish Flying Club ...	29.8.39
19,933	Reginald Carr	Doncaster Aero Club ...	29.8.39
19,934	John Leslie McGovern	York and Leeming F.C. ...	29.8.39
19,935	Thomas Atkin	York and Leeming F.C. ...	29.8.39
19,936	Francis Roy Stamp	Plymouth and Dist. Ae. C.	29.8.39
19,937	Arthur Fanthorpe	Hull Aero Club	29.8.39
19,938	Charles Ernest Towers	Leicestershire Aero Club	29.8.39
19,939	Geoffrey Richard Lawrence Sykes	Wiltshire Flying Club ...	29.8.39
19,940	Clive Maurice Davis	Redhill Flying Club ...	29.8.39
19,941	Hubert George Sharp	Wiltshire Flying Club ...	29.8.39
19,942	Julian Field	Wiltshire Flying Club ...	29.8.39
19,943	John Vanston Roberts	London Air Park F.C. ...	29.8.39
19,944	Robert Eric Frewer	Luton Flying Club ...	29.8.39
19,945	Rex Biggs	Luton Flying Club ...	29.8.39
19,946	Patrick Bernard George Davies ...	Surrey Flying Services ...	29.8.39
19,947	John Henry Sims	Southend Flying Club ...	29.8.39
19,948	William Douglas Sullivan ...	Southend Flying Club ...	29.8.39
19,949	Roy Cuthbert Saunders	Southend Flying Club ...	29.8.39
19,950	William Joseph Turner	Blackpool and Fylde Ae.C.	30.8.39
19,951	John Hardy	Blackpool and Fylde Ae.C.	30.8.39
19,952	William Alban Tamblin	London Aeroplane Club...	30.8.39
19,953	Gerald Armstrong Payn	Cinque Ports Flying Club	30.8.39
19,954	Angus Stevenson Binning ...	Witney and Oxford Ae. C.	30.8.39
19,955	John Guy Millar	Redhill Flying Club ...	30.8.39
19,956	Arthur Patrick Desmond Osland	Redhill Flying Club ...	30.8.39
19,957	George Warwick	Bedford School of Flying	30.8.39
19,958	Arthur Alfred Webster	Isle of Wight Flying Club	30.8.39
19,959	Thomas Frederick Rimell ...	Worcestershire F.C. ...	30.8.39
19,960	Arthur Robertson Coats	Worcestershire F.C. ...	30.8.39
19,961	John Neville Ryland	Worcestershire F.C. ...	30.8.39
19,962	John Richard Hughes	Worcestershire F.C. ...	30.8.39
19,963	Clifford Cunnington	Lancashire Aero Club ...	30.8.39
19,964	John Saunderson Gaunt	North Staffs Aero Club ...	30.8.39
19,965	Louis Humphreys	South Staffs Aero Club ...	30.8.39
19,966	John Cecil Philip Taylor	London Air Park F.C. ...	30.8.39
19,967	Stanley James Slade	London Air Park F.C. ...	30.8.39
19,968	Norman Sidney Head	London Air Park F.C. ...	30.8.39
19,969	Ursula Pearsall Spicer	London Air Park F.C. ...	30.8.39
19,970	Leonard John Greenwood ...	London Air Park F.C. ...	30.8.39
19,971	Harold Rhodes	London Air Park F.C. ...	30.8.39
19,972	William David Webster	Scottish Flying Club ...	30.8.39
19,973	Charles Sutherland Rombach ...	Scottish Flying Club ...	30.8.39
19,974	Samuel James Miller	Herts and Essex Aero Club	30.8.39
19,975	Sydney Saddleton	Herts and Essex Aero Club	30.8.39
19,976	George Lawrence Barrett ...	Herts and Essex Aero Club	30.8.39
19,977	Ernest Bishop Cooper	Lincolnshire Aero Club ...	30.8.39
19,978	John Carter	Midland Aero Club ...	30.8.39
19,979	Wilfred Swann	Midland Aero Club ...	30.8.39
19,980	Lionel Wilk	Midland Aero Club ...	30.8.39
19,981	Benjamin Stephen Besnard Johnston.	West Suffolk Aero Club...	31.8.39
19,982	John Lougher Ridsdale	Cardiff Aeroplane Club ...	31.8.39

"A. VIATOR" POPS UP AGAIN

Two Weeks' Croydon Notes in W.P.B. : The Peculiarities of Invisible Ink : On Scrounging and Rent-collecting

SINCE I unbuckled the sword at the end of the "Great" War to end war and all that, and took penner and inkhorn instead, I have been convinced that the pen is mightier than the sword.

Nowadays the sword of the censor, tipped with the stuff blue pencils are made of, is mightier than any pen in my quiver except the special one which I have been using for the last couple of weeks, as you may or may not have noticed.

Possibly I have been too cunning, for my week-before-last stuff, sent in on apparently blank paper, was written, not without tears, in onion juice. When they failed to appear, I wrote last week's in milk. They were not published either, and it may be that the Editor does not know that you must warm secret onion writing on a brisk hot water bottle, preferably at midnight when the moon is full, and that milk-writing responds, semi-successfully at least, to a couple of hours' rubbing with a practically red-hot brick soaked in beer.

Well, if I have anything important to say in future I shall send it in written in stronger terms, say, for example, garlic or Bristol milk which, you'll agree, are about as powerful in their categories as any secret-writing materials in possession of the enemy, although I can't say I have the secret of that jet-black but rapidly disappearing ink Ribbentrop uses for treaties.

And now for my Croydon (pardon) notes, which you, in your innocence, thought you had got rid of on the grounds that war, however terrible, has its compensations. Naturally, you supposed I had been enlisted, interned, or, on forged testimonials, had entered the censorship. Possibly you blamed me for all these 'orrible blunders whereby news that was being broadcast all over the world was secret to our own newspapers until just too late for publication, and was then (a) withdrawn and (b) released with a desire that the most should be made of it.

Evacuation

No, I was not in that racket, but was being almost forcibly evacuated, me and my manservant and my maidservant (or lady typist), my ox, my ass (but him I left behind me) and the stranger within my gate. He was a mere passenger, by the way, enquiring for a ticket to —— (censored), and they chased him up and down and round and round the airport, and finally interned him for the duration, in spite of the fact that he was a Rutland man.

People came to me and said "What furniture are you leaving behind" in a hopeful sort of way, and departed aggrieved when I showed them a drawing pin with no pin to it, remarking "Not even that, me old Mark IV Q.M.S. I was had that way as a downy subaltern in 1914. Yes, yes, I know you'd sign for it—in some undecipherable name—but don't trouble. The only thing I'm leaving you is yonder inkstain on the wall, and if absentees interest you, a missing pane of glass in the window there. Go therefore and plunder some other mug before it is too late. My lorries wait without."

So for my part I left with dignity and, I flatter myself, through a perfect barrage of thoroughly well-deserved howls of execration from the incoming tenant.

Sad, leaving Croydon, of course, but towards the end it certainly became no place for a young man of rigid upbringing, and here am I, somewhere in England, in one of those shooting suits guaranteed to deceive the grouse, because it is exactly the same colour as the greenest grass, the reddest plough, or the most glaring concrete road. I also have a fine tin hat and a lovely service respirator, and I often wonder if the Q.M.S. who came to ask me what furniture he was about to win off me ever found out exactly where he laid them aside when our little talk commenced. He was young at his trade, was yon lad, whereas I was Hon. Scrounger to my battalion somewhere devilish secret in France, way back in 1914.

I shall never forget the gargantuan barrel of wine on wheels, complete with two oxen—but, after all, the C.O. *did* say to me, peevish-like, "What about a little wine, eh, what?" Mind you, that wasn't the scrounging I got into a bother about, which was an altogether bigger affair and cannot be gone into here. Crikey, what a war this is. Strike me pink! Fancy going to war in slacks and a cloth belt. Where are the beautiful mahogany boots, with Sam Browne belt and complexion to match, which made the barmaids of yester-year get all of a flutter so that they poured you out a treble and got so interested in your war yarns that they never charged you for it, though all the time, with characteristic modesty (nearly censored) you had asked for a "small single whisky, please, Aurora."

But, anyhow, why these sloppy slacks, tell me, someone? Is it mechanisation or an epidemic of varicose veins? It just is not done to go to war in your pants. Besides, there is the risk of getting bitten in the calf by a dog.

Talking about partridge-deceiving tweeds; that sort of thing can go too far, as Colonel Uppelbow remarked when a 200 m.p.h. low-flying, down-wind bird failed to observe him, owing to his moorland mixture suiting, and flew straight into his solar plexus immediately after lunch.

Navigation

Much the same applies to our airport, the name of which wild horses would not drag from me, but which you can easily find if X is your point of departure and you fly N.N.W. by E. for a number of miles known as Y and then change course from time to time until you recognise the tiny hamlet or prosperous manufacturing town of Knott-atte-Whoame.

From there all would be plain sailing for a good navigator, except for the skilled way we have camouflaged the place. As things are, heaps of interesting planes, including old friends, some of them very old, with the wind whistling through their rigging, pass right overhead and land elsewhere, though *we* are their true destination.

The secret of our camouflage, I am specially permitted to reveal, is that we have taken the black-out as our model and painted everything pitch black. Even in sunny weather it's night with us, so that airmen, hostile or otherwise, sheer off and leave us alone because night landings are not only awkward but forbidden.

They might suspect something in daytime but for the fiendish cunning of our airport manager, who has placed silvered cardboard stars all over the landing ground and, more ingenious still, has fellows standing by to place bowler hats over some of them at intervals so that they twinkle.

There is one stupendous bit of news this week, about the Civil Air Ministry official who is (a) unaware that there's a war on, and (b) has no knowledge officially that Croydon has been evacuated by civil firms, including D.L.H., and (c) that it (Croydon) is now a peaceful Government rabbit farm, as envisaged by the Maybury Committee.

This gloriously unperturbed chip of the old Civil Service block was paid rentals, housing, landing, and other fees up to the day of the departure of all hands, but in his well-thumbed book of words it says that all such charges are payable monthly in advance.

Well, stop me with a three-pronged tuning fork, pals, if he isn't sending in his little requests for the jolly month now current. I haven't the least doubt that he is industriously invoicing D.L.H. Berlin for September housings, landings and rentals and wondering why nobody pays any attention to him.

Query: Is he trading with the enemy? Write us a postcard, chums. Wot would *you* do to him?

THE INDUSTRY

Plating on a Large Scale

ONE of the largest electro-plating and metal-finishing plants in the country was recently made available for use on contract and sub-contract Government work. The plant is installed at the works of Wilmot-Breeden, Ltd., of Eastern Works, Camden Street, Birmingham, 1. The Wilmot-Breeden plant is particularly unique in that it is capable of dealing not only with big quantities of material rapidly, but it can also handle parts of large dimensions. Some of the depositing vats are 24ft. in length.

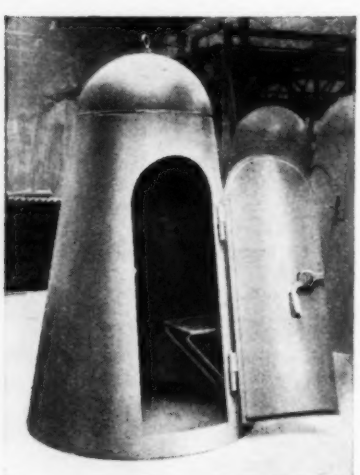
The protective treatment of parts constructed of steel, aluminium, magnesium, light alloys and other metals can be readily undertaken to A.I.D. specifications, including anodising and chromating treatments. The plant can also be adapted to the production of heavy nickel deposits ranging from 0.002in. to 0.01in., or heavier if necessary, on steel and other base metals. Another application of this same process can be used for building up worn metal parts.

Where it is necessary to protect metal surfaces liable to be subjected to exceptional wear, chromium of considerable thickness can be applied direct by the Wilmot-Breeden plant. Facilities are also available for electro-tinning and lead facing.

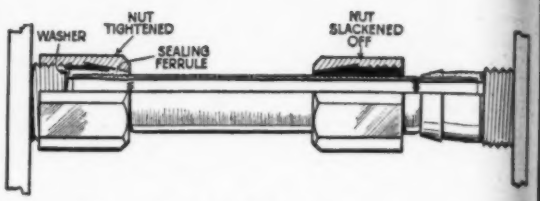
In short the plant at Eastern Works is readily adaptable to almost any electro-plating process, while Wilmot-Breeden technicians are ready to discuss the undertaking of any special process in addition to those already mentioned.

A Vickers Appointment

IT is announced that Mr. F. C. Yapp, a director of Vickers, Ltd., and Vickers-Armstrongs, Ltd., has been appointed to the position of deputy chairman of Vickers-Armstrongs, Ltd.



A number of Consol steel shelters have recently been installed at Buckingham Palace and St. James's Palace. This type of shelter, which is designed for the protection of key personnel, can be easily lifted from one point to another. It is made by Constructors Ltd., of Nickel Works, Erdington, Birmingham, 24.



In the Crownall coupling system a shouldered ferrule is compressed on to the tube end by a gland nut. The tube can be removed or fitted into place without springing.

The Crownall Pipe Coupling

WITH the majority of pipe or tube couplings it is necessary for the end faces to be registered up and into the coupling body otherwise a joint cannot be made. In the case of the Crownall patent coupling it is not necessary for the tube to be registered inside the body of the coupling. Unions can, therefore, be made without the necessity for the heavy springing of a pipe into position.

In the Crownall system a small-shouldered ferrule is fitted over the end of the tube after first slipping on the gland nut. When the latter is screwed on to the coupling body or flange it compresses the ferrule on to the surface of the tube or pipe. The inner surface of the ferrule is serrated so that after the gland nut has been initially tightened the ferrule becomes firmly contracted round the pipe. In this manner the usual number of loose parts is eliminated. Should the ferrule become damaged it is quite a simple matter to replace it with a new one.

Because of the design of this type of coupling it is possible to make or break the joint without having to bend or spring the pipe into position. Exhaustive tests have been carried out by the National Physical Laboratory up to pressures of 8,288 lb./sq. in. and 6,496 lb./sq. in. on couplings for ¼in. × 17 w.g. and ½in. × 18 w.g. tubes respectively. In each case the pipe burst while the couplings remained sound and unaffected. Crownall patent couplings are made by Tube Patents, Ltd., 17, The Broadway, Wimbledon, London, S.W.19.

In Brief

THE Aircraft Engineer supplement, which would normally appear in this issue of *Flight*, will be published next week.

* * *

The Northern Aluminium Co. announce that the price of its aluminium paste pigment for the manufacture of aluminium paint has not been advanced and every effort will be made to maintain the standardised charges ruling prior to the outbreak of war.

* * *

Over 2,100 employees of the General Electric Co., Ltd., are serving with the Combatant Forces. One-third of the total male staff in the sales organisation is with the colours.

* * *

Callender's Cables and Construction, Ltd., announce that its factories are being kept in full production to a degree limited only by the recent official regulations. The head offices remain at Hamilton House, Victoria Embankment, London, E.C.4.

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An interesting A.R.P. instruction booklet has been issued to every employee of British Timken, Ltd. It describes in detail the correct procedure during an air raid, first-aid treatment of gas casualties and also serves as an identity card. Copies of this booklet have been circularised to a large number of aircraft firms.

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On and after last Saturday, September 23, the use of aluminium and aluminium alloys for the purpose of any manufacture and work will require a licence granted by the Minister of Supply under an order issued by the Ministry of Supply dated September 9, which also makes the sale and purchase of aluminium and aluminium alloys in Great Britain subject to a licence. Applications for licences should be addressed to Ministry of Supply, Aluminium Control, Raven Hotel, Castle Street, Shrewsbury.

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The General Electric Co., Ltd., wishes to state that the Osram Companies referred to in the official list of enemy concerns (Trading with the Enemy Act) are subsidiaries of the Osram G.m.b.H., of Berlin, and have no connection of any kind whatsoever, financial or otherwise, with the G.E.C.

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On September 18 the head office of the British Aluminium Co., Ltd., was moved from Adelaide House, King William Street, London, E.C.4, to new and larger quarters at Norfolk House, St. James's Square, London, S.W.1. (Telephone: Whitehall 7822).

NEW COMPANIES

In the notes below, for reasons of space, the "objects" of new companies are usually somewhat abbreviated.

CENTRAL AIR TRAINING SCHOOLS, LTD.—Capital £2,000. To train pilots and teach flying, particularly by use of the Link Trainer. Directors to be appointed. Solicitors: Wingfields, Halse and Trustram, 61, Cheapside, London, E.C.2.

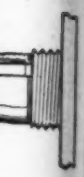
M. & W. PATENTS, LTD. (356,394).—Capital £1,000. To acquire patents belonging to A. A. Miller for carrying on the business of manufacturers and dealers in engines, motors and apparatus, electrical equipment and accessories of all kinds used in motor cars, aeroplanes and airships. Directors: W. G. Wilson, F. S. Spriggs, G. Wilson and A. A. Miller. Solicitors: Johnson, Weatherall and Co., 7, King's Bench Walk, E.C.

AERO HYDRAULICS, LTD.—Capital £100. To design, manufacture and repair hydraulic, pneumatic, electrical and other apparatus. Directors to be appointed.

BLACKPOOL FLYING SCHOOL, LTD.—Capital £100. To establish and operate an aviation school. Directors: A. Knowles (767, Belmont Road, Bolton), E. Knowles, W. Westoby.

LAND CLEARANCE (SUTTON COLDFIELD), LTD.—Capital £200. Timber fellers and general land clearance experts for building sites, aerodromes, etc. Directors: Mrs. F. R. Higginson, L. H. Jennings. Registered office: 90, Rectory Road, Sutton Coldfield, Warwickshire.

DUCELLIER SALES (GREAT BRITAIN), LTD.—Capital £200. To carry on agencies for import, export, purchase and sale of automobile and aircraft electrical equipment, particularly the products of Etablissements Ducellier Société Anonyme, 45, Rue Alexandre Dumas, Paris, France. Directors: Ronald E. Warlow and Benedictus Geleerd. Registered office: 7, Conduit Street, London, W.1.



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